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Electrical World

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Weston

The Interesting History of Weston Instrument Transformers

A very serious problem confronted the Weston Company a few years ago, at the time it had perfected its now world-famous group of A. C. Switchboard Indicating Instruments.

The Company had developed these Instruments to the highest state of perfection, but unfortunately there were on the market no Transformers of sufficient accuracy and serviceability to use in combination with them. Exhaustive tests were made on all types of Transformers available in this market, and the Weston branches and representatives in foreign lands were commissioned to scour the field and send samples of the best Transformers procurable.

Not one of the Transformers thus obtained in this country or abroad even approximately met the requirements.

The Weston Company did not want to make Transformers, because of other work it deemed of greater importance; but failing to find Transformers that it could recommend to be used in conjunction with Weston Instruments with assurance of accuracy better than 1 per cent for the combination, it endeavored to have them built to special designs. Even then the results were far from satisfactory.

Realizing finally that the problem of Instrument Transformers was one that must be solved as other Weston problems had been solved, the Weston Engineering Staff thoroughly analyzed the subject and completed designs for various groups of Portable and Switchboard types of Current and Potential Transformers of a degree of accuracy and serviceability that completely met the practical requirements of switchboard practice and precision determinations in the laboratory.

These Weston Transformers established a new standard for Instrument Transformer design and construction.

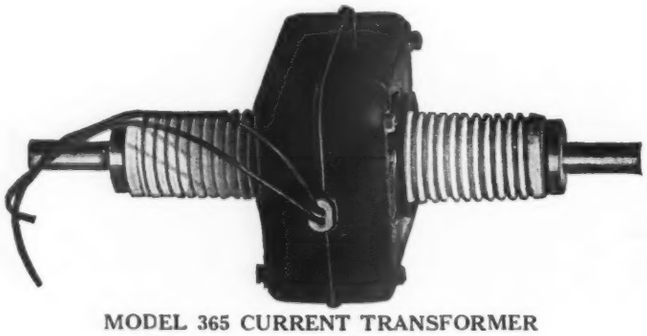
As might have been prophesied, the improvements made by the Weston Company resulted in improvements on the part of other instrument manufacturers, and this is one more instance of apparatus remaining stationary, so far as merit was concerned, until a Weston type blazed the way for betterments. The significance of this is apparent.

Model 312

PORTABLE INSTRUMENT TRANSFORMER

Weston Switchboard Instrument Transformers described in Bulletin 1501.

Weston Portable Instrument Transformers described in Bulletin 2001.



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Weston Electrical Instrument Co.

Electrical World

The consolidation of Electrical World and Engineer and American Electrician.

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Getting at Costs

THE necessity of ascertaining costs in a uniform manner has been brought home to every concern in the electrical manufacturing industry very forcibly of late by the work of the cost accounting committee of the Electrical Manufacturers' Council, embracing the Electrical Manufacturers' Club, the Electric Power Club and the Associated Manufacturers of Electrical Supplies. Nor has this realization come any too soon. With war revenue measures designed to tax excess profits it is imperative to know exactly what profits are, and to obtain this information some recognized and authoritative accounting and cost system must be applied. The government is also now planning extensive purchases on a cost-plus-percentage basis so that the elements which go to make up manufacturing costs will be officially defined. If, therefore, there is a fair understanding of these matters before contracts are distributed, it will save both the manufacturer and the government considerable expense in checking up the cost figures. But, regardless of whether companies are at work for the government or not, it is plainly apparent that a standardized system of accounts should straightway be put into effect, if for no other than purely selfish reasons. We therefore urge whole-hearted and prompt co-operation with the accounting committee of the National Manufacturers' Council in the rapid adoption and promulgation of its system of accounts.

Room for Electric Vehicles

JUST now the air is resounding with the familiar wail of "Gas going up again," and those who drive motor vehicles may well pause and consider where the rise is likely to stop. Prices have an unpleasant way of being lifted on a ratchet with no available method of release. In this emergency it is certainly worth while to push the electric vehicle energetically, both for the ordinary work of the automobile and for trucking and industrial use. To those who use motor vehicles for pleasure only the supply of fuel perhaps will not count at first very heavily; but when it comes to the matter of commercial vehicles the situation is quite different. The owner counts the cost very carefully, and good as many of the gasoline trucks and delivery wagons are, the cost of fuel and the constant elements of wear and tear cannot be neglected.

As the war progresses a heavier and heavier demand for gasoline must be reckoned with. Thousands upon thousands of motor trucks, motor ambulances and tractors will be required at the front, thousands of aeroplanes must be kept supplied, and hundreds of powerful motorboats, consuming fuel at a tremendous rate, will be put into service on the seacoast. All these are likely to cause so huge a demand for gasoline that the price is bound to mount higher and higher. It would therefore seem to be sound policy on the part of the electric supply companies to encourage in every way possible the use of electric vehicles, following up the campaign which has been on for several years with still further energy. It not only will encourage the use of a thing which is extremely good in itself, but will tend greatly to relieve the gasoline situation at a time when the war demand for fuel is rapidly increasing. In the factory the opportunities are beginning to loom large, and the outlet here may eclipse in a few years the ordinary applications on the streets and highways. An article in this issue gives an excellent survey of conditions and possibilities in the industrial field and well merits close study. It shows applications of storage-battery trucks in work for which they are well fitted and in a direction in which there is no competition.

A New Trail Blazed in California

THE commendable spirit of co-operation among California power companies has made it worth while for the California Railroad Commission to propose the connection of all important transmission lines into a well-knit state-wide system. The purposes are to stabilize service, cut down cost of production, and utilize stream flow more effectively by facilitating interchange of energy; in other words, simply the end that would be sought were all companies managed by one parent body considering the welfare of each while acting for the best interests of all. The plan originated with the commission as outlined in the news item published last week; but before the scheme as a whole could be presented, even before the completion of the general survey, the power companies began to take a keen interest in the idea. The Pacific Coast Section of the National Electric Light Association is now working on it, and some companies are already responding cordially.

Technically, perhaps, the most important advantage in a territory served by streams of diversified flow is getting onto the same system a wide diversity of demand. Thirty thousand to 40,000 hp. of power can be added to the State's total without installing additional generating equipment, F. E. Hoar of the Railroad Commission believes, by merely connecting existing systems so that stream flow diversity can be considered as a whole instead of individually. The plan would foster closer co-operation between companies and re-

duce undesirable competition with its attendant litigation before the Railroad Commission. Once all companies are connected to a state-wide system the activities of commercial departments could be broadened most effectively, and of course these elements all tend to reduce the cost of operation. With the proposal of so comprehensive a plan for physical consolidation of California transmission systems, the question naturally arises, Will this tend toward consolidation of organizations? This was not a part of the original plan, but it has developed incidentally.

In fact, the merging of eight small companies into larger corporations which could probably serve the territory more economically is already being considered. In those cases where a small company is under the handicap of high overhead and finds efficient management difficult and costly, absorption is indicated. On the other hand, if present organizations are able to operate profitably with reasonable rates consolidation is not so desirable. The criterion must be economy of operation. The public has a right to the lowest fair rates, and if the greatest economy lies in a combination of systems, this will surely be the ultimate result. The small companies in critical financial condition should welcome the situation, and those that are doing well have no cause to fear it. The plan has merit from many angles, and the fact that it is being favorably received sets an excellent example for competitive companies elsewhere that have not learned to pull together.

Give Us More Water Pressure

WE BESPEAK earnest consideration of Hugh L. Cooper's paper on the water-power situation. It is quite in line with our editorial suggestion that true conservation requires the intensive use of electric power to remedy the waste of transporting coal. Mr. Cooper puts the case for water powers forcefully and in a way which should appeal to the intelligent public. Stupid lack of legislation is responsible for a great deal in this country of ours, among other things for the annual waste of water power—a waste irretrievable since every gallon of water that falls unutilized to sea level has failed of its duty toward mankind.

Ultimately one must expect an enormous increase in water-power developments, but the slow progress of the last fifteen years is not entirely due to either lack of legislation or improper legislation. Other facts enter into the situation. The first decade of water-power development, from 1893 to 1903, produced installations at a rate which in the nature of things could not be expected to continue. The first hydraulic privileges chosen for working were selected on sound economic principles. Either they could be developed very cheaply, or they were near certain profitable markets, or, being more distant from markets, they were in competition only with high-priced coal. The first few million horsepower represented a situation more promising than could have been obtained from the next few million, or from the succeeding millions of horsepower less favorably situated in cost of water developed. The large hydraulic privileges now existing are for the most part very far distant from markets or expensive to develop. Despite the short-sighted attitude of the government toward the powers in its control, these make up but a small part of the total 35,000,000 hp.

Very marked in its practical effect on the hydroelectric situation has been the advent of the great steam turbine, showing an efficiency hitherto unapproachable with steam plants and making it evident that, given reasonably cheap fuel, power could be supplied at a price scarcely attainable by the average hydroelectric station. The situation is therefore from the standpoint of dollars and cents far more complicated than Mr. Cooper indicates, but at this time his contentions should be taken very seriously as pointing the way to large savings in labor and transportation. We are living in a period in which the price of coal, including transportation, has reached a figure which upsets all previous calculations regarding the relative economy of steam and water power. We have been thrust long before our due time into a situation which makes it possible economically to develop water powers usually classed as undesirable. If pushed quickly into service, many of these would prove most valuable additions to the country's resources and would release, as Mr. Cooper shows, large amounts of labor and of transportation facilities. While many a water power is in and by itself relatively unprofitable to develop on account of its distance from any specific markets, it may still be tremendously useful if cut in on an existing system to form part of the general power supply. This is along the line of least resistance in hydraulic enterprises, and it should be assiduously followed if we hope to gain quickly the greatest return from our unutilized hydraulic privileges.

Low-Temperature Electrothermal Processes

IT IS a well-recognized fact that heat can be produced on a large scale more economically in a fuel furnace than in an electric furnace, except where water power is abundant and fuel difficult to secure. Nevertheless, heat can often be produced on a small scale much more economically by the electric furnace than by fuel; while in particular industries the electric furnace is more economical than the fuel furnace, even on a large scale, owing to special advantages attending the electric process. The electric toaster on many a breakfast table and the electric range in many a kitchen indicate that, in long-range economy, electrically produced heat may have a great advantage over heat produced by fuel.

A good example of the advantages accruing to electric-furnace heating in certain industries was cited in a recent paper by C. F. Hirshfeld, before the American Electrochemical Society, referring to low-temperature baking for japanning and foundry core work. It is well known that japanning is an art requiring considerable experience and skill for its successful conduct. Moreover, there has always been much uncertainty and guesswork about it, owing to the large number of variables

which enter into the process. Some of the most successful japanners appear to have no quantitative rules governing their procedure. They have reduced their success to a habit, but any departure from the stereotyped technique would be likely to perplex them. All industrial processes start in this rule-of-thumb fashion and gradually evolve into scientific processes as the meaning and value of the different steps become interpreted through painstaking research. Mr. Hirshfeld showed how research has already modified the japanning process to commercial advantage in certain industries by simplifying and stabilizing the technique. The electric furnace enables the baking to be carried on in a perfectly definite manner, capable of being repeated precisely through an indefinite number of trials. Moreover, electric heating of a lacquered metallic object appears to be largely from the metal outward; whereas gas-furnace heating is more from the outside of the lacquer inward, with a greater tendency to ebullition in and disruption of the layer. It is the great definiteness and reproducibility of electric heating that give the electric furnace its value in such cases.

In the competition among industrial processes those which can be scientifically adjusted and controlled are likely to displace, in the long run, the more primitive and rigid processes. The electric furnace enables the careful experimenter to study the effects of thermal changes in his processes much more surely and conveniently than is ordinarily possible with the fuel furnace. The electric furnace is often therefore a great aid to industrial research and to new results.

Centralizing Energy Production from Fuel

AT THIS time it is the plain duty of a central station to make as vigorous a drive for additional power load as it is possible to organize. The country is in a curious situation with respect to its fuel supply. Of fuel there is an indefinitely great amount. Facilities for fuel transportation we fondly believed were adequate until the strain of the last two years began to make itself felt. As the case stands those facilities have broken down owing to the enormous pressure of other kinds of freight, chiefly moving eastward, a limited supply of rolling stock to accommodate it and, above all, the inefficiency of freight distribution. The methods of handling cars destined for anything but through routes seems to be crude in the extreme, so that instead of actually utilizing the rolling stock it is laid up in indefinitely great quantities for transshipment and in process of unloading. The net result is that the consumer of coal who is not receiving it over a comparatively straight line and in large quantities finds himself trapped. He can only get his fuel with great difficulty and at enormously enhanced price. Water transportation counts for very little.

Now is the time to get after the consumers of fuel for industrial purposes to transfer their load as far as possible to the big central stations, which are able to obtain fuel somewhat directly and to utilize it at an enormously higher efficiency than is possible on a small scale. Now if ever, too, is the time for a further upbuilding of transmission networks so that small stations struggling with a rapidly increasing fuel bill may be able to utilize wires instead of railroads for obtaining their supply of energy. This phase of the matter is one on which it is difficult to lay too much stress. We have repeatedly discussed the meshing of electric systems into networks, but there has never been a time when the benefits to be obtained are comparable with those which may be secured at present.

The situation, in a word, is this: Owing to the difficulties, chiefly in transportation, due to the changes wrought by the war, fuel is at a figure which normally might not have been reached for another fifty years, perhaps not then. The economic conditions have changed enormously in the last two years, and everything points to the need of furnishing power to the country from the relatively few points at which fuel is readily obtained and where it can be most efficiently utilized. Wholesaling electric power has been one of the notable advances of the last few years. The present conditions call not only for the application of this for the relief of the smaller stations, but for an enormous increase in the retail business among manufacturers. The only adverse condition is the rise in price of electrical machinery. This from the standpoint of the central station man is unfortunate, but it should not check efforts to turn industrial power production into a business belonging to the central station, carried on on a great scale, and under favorable conditions, instead of allowing it to go on as at present wasting fuel and wasting transportation at a time when both are seriously needed.

The Coming Issues

RELATIVE estimates of the total power used for handling the large grain crops of this continent are not readily obtainable, but the aggregate power used for handling and cleaning grain must be many hundred thousand horsepower. Much, if not all, of this load is available to the neighboring central stations. On account of the unprecedented demand on this country for its grain output, every central station should be in readiness to serve grain elevators in its vicinity. Extensive data based on the performance of several elevators will be presented in the next issue of the ELECTRICAL WORLD to assist central stations in providing for such loads and to help engineers who are supervising the equipping of new elevators or trying to increase the efficiency or output of existing elevators. The fifth installment of C. E. Clewell's series on industrial illumination will also be presented. This article will point out the relation of the first cost of lighting equipment to the total cost of factory building and its components such as elevators, cranes and ventilating equipment. Costs of operating the lighting installation, nature of work as a factor in lighting problems, essential qualities of lighting systems and the use of tungsten lamps will also be discussed. Besides the regular departments, there will be an article showing the economy, both as regards labor and increased production, of electric industrial trucks in the Willys-Overland factory.

Timely Economy of Industrial Electric Trucks

Extraordinary Development in Last Two Years of These Electrically Driven Equipments, Which Intensify Production and Save Labor—Battery Charging a Valuable Off-Peak Load

WITHIN the last two years a wonderful development in what might be called the field of intensive transportation has taken place by aid of the industrial electric truck. In many quarters the achievements of these small but powerful units of transport are little realized. The attention given to electric and gasoline vehicles designed essentially for highway service over extended areas has led not a few central station men, mill owners, terminal operators and merchandise handlers to overlook the usefulness of the industrial type of truck. The increasing cost of labor and the pressure upon all plants allied directly or indirectly with war service to cut the time of production to the minimum consistent with high-grade work is leading to a much wider recognition of the accomplishments and possibilities of what has been so aptly called "the little brother of the commercial truck." It is a question if any motor-driven tool available to-day for the use of a hard-pressed industrial world stands ready to speed up production more efficiently than this specialized type of electric vehicle. This readiness to serve the nation's plants, warehouses, terminal yards, arsenals and merchandising establishments is based upon the successful operation of about 5000 industrial electric trucks in all parts of the civilized world, 4000 of which are in service in the United States and Canada. There is nothing experimental about the modern industrial truck as an efficient economic tool.

RECENT STATUS OF MANUFACTURE

Industrial electric trucks are to-day being produced in America by about a dozen manufacturers. Their present cost ranges from about $1,100 to $2,500, according to size and design. Units of 2 tons (1.814 t.) capacity, costing around $2,000 each, are in general use. The average industrial truck saves from $5 to $7 per day in wages, depending upon the materials handled, the length of haul, local cost of labor, etc. In some munitions plants a saving of $18 per day per truck is being realized. With intensive use an industrial electric truck will often pay for itself in from one to two years. The average laborer employed in pushing a hand truck can be taught to operate an electric equipment in half a day, with the result that his duties are vastly lightened although increased production of transportation results to a fivefold degree. It has been found desirable in establishing such service to instruct the local superintendent or chief electrician in the use of the truck, running the unit light about the plant at first and then assuming loads. These local officials then select the truck operator or operators and in this way exercise a salutary control over the use of the equipment, the permanent truck operator being taught by his superiors.

The usual speeds of the industrial electric truck loaded range from 5 to 7 miles (8.0467 to 11.2654 km.) per hour, compared with about 2 miles (3.2187 km.) per hour in hand stevedore service. Well-designed trucks can be stopped almost instantly and well within their length when operating at full speed, a factor of great value in the rapid handling of merchandise in congested areas and aisles. The use of a single direct-current motor of the series type is general for truck driving; the control provides for several speeds forward and reverse in acceptable designs, and in case the operator steps off the machine current is immediately cut off by an automatic switch. Various types of driving gear are in service, including worm gearing, chain drive and spur gearing with differential. Steering is of the two-wheel and four-wheel type, and the turning radii of the latest designs are very short. A representative two-wheel steer type in which special attention has been given to this feature has a turning radius of 7 ft. 3 in. (220.98 cm.), the over-all length of the truck being 7 ft. 6 in. (228.6 cm.), and a drop-frame type of truck with four-wheel steer has a turning radius of 5 ft. 8 in. (172.72 cm.), the wheel base being 52 in. (132.08 cm.) and the over-all length 8 ft. 10 in. (269.24 cm.).

Roughly speaking, about half as many cells of storage battery are ordinarily installed for industrial truck service per unit as are required in heavy commercial truck work. Modern trucks are equipped with cells of various makes and numbers, twenty cells of lead battery

THE APPLICATIONS OF INDUSTRIAL ELECTRIC TRUCKS ARE MANY AND VARIED

Reading from left to right, top row first: (1) Handling Green Tires, (2) Hauling Fish Carts, (3) Transporting Pulleys, (4) Hauling Ammunition at Government Arsenal, (5) Truck with Trailers in Cotton Mill, (6) Speeding Up Machine Shop Production, (7) Loading Steamship on Pacific Coast, (8) Hauling Hospital Supplies, (9) Taking Cloth to the Bleachery, (10) Transporting Bolts of Cloth Through Heavy Snow, (11) Relieving Freight-Yard Congestion, (12) Eating Into Pile of Wire Fence Bales

or thirty-six cells of alkaline battery being frequent installations. Charging is accomplished by the aid of a variety of switchboard panel equipment, its design depending upon the number of batteries to be charged at any one time, the number of cells per battery, type of battery, capacity of cells and conditions of energy supply to the switchboard. A fair average of 18 kw.-hr. to 20 kw.-hr. per day covers the energy demands of a 2-ton (1.814-t.) truck in active service, and the charging may be done through a motor-generator set, rotary converter or rectifier, although the last-named appears to be going out of use in favor of the former types of equipment. Where direct current at 110 volts or lower is available, as in many mill plants, the charging panel need contain no provision for machine transformation, the reduction in voltage being obtained rheostatically. The use of the motor-generator or the rotary converter where alternating-current supply is utilized for truck battery service enables the central station to enter the field of battery charging at any point on its system. In the great majority of industrial plants truck battery charging occurs during the night, thus enabling the central station or the private plant to handle the service without additional investment in generating station equipment.

In round numbers, the cost of charging equipment for one industrial truck runs in the vicinity of $200 to $500, depending upon the amount and type of apparatus required. In some cases it is possible to use a second-hand motor-generator set of about 4-kw. rating to advantage; in others new equipment may be essential throughout, including automatic switching equipment to cut off the supply of energy in case the voltage of the charging circuit falls below a predetermined limit, or in case of reversal of the charging current. The cost of charging equipment per truck decreases rapidly with the number of trucks in service.

Wide Geographical Distribution of Trucks

Seventy-five industrials are in use at the North and South Stations in Boston, Mass., and in all New England about 600 trucks are in service. In the celebrated Naugatuck Valley of Connecticut 200 trucks are in service in brass plants and other establishments active in munitions work and other production. Many of these trucks are in use on steamship piers in New York, on the Pacific Coast, in New Orleans, in Pennsylvania Railroad stations, and in textile mills North and South. Later developments include trucks with an extra motor used in elevating the platform a few inches so that the platform can be run under a loaded frame, box on castors or cradle to take the merchandise without breaking bulk to a new location, where the platform is lowered and the merchandise delivered with minimum loss of time in plant departments. Another very useful development is the crane type of truck, which is proving a valuable labor-saving device in shops in the assembly of automobile engines, transfer of fabricated metal parts, loose material in buckets, etc. Trucks are giving admirable service even on grades of 15 to 30 per cent in mill yards, and the annual costs of operation are low. Thus, it is estimated that an ordinary industrial truck can be operated at a total cost of about $2.25 to $2.50 per day exclusive of wages, allowing $1 for interest, insurance, taxes and depreciation (10 per cent for the last) and $1 for battery and mechanical replacements. The cost of energy may run from $0.18 to $0 50, depending on the rate for energy, the latter corresponding to a central station rate of about 3 cents per kilowatt-hour. A central station should be able to count upon a revenue of at least $150 per truck per year in this class of service, at rates commonly in vogue for wholesale battery charging or large-scale energy supply.

Data from Many Industries

The proof of the pudding is in the eating, and in the following paragraphs data are given from industrial truck installations, indicating the economic advantages of these machines:

Handling Lumber.—Size of lumber carried, 12 in. by 16 in. by 11 ft. 2 in. (30.48 by 48.77 by 340.36 cm.); average load per truck, six pieces, 3600 lb. (163.29 kg.). In one hour truck made sixteen trips, carrying 28.8 tons (26,126.9 kg.); round-trip distance 800 ft. (243.84 m.); total distance traveled, 12,800 ft. (3901.44 m.). Eight men loaded, unloaded and operated the trucks at a cost of $2.40. Allowing for wear, tear, depreciation, etc., at 20 cents, the cost came to $2.60, or $0.09 per ton ($0.099 per t.). The cost of haulage and loading, unloading, etc., by hand, would be $0.36 per ton. ($0.386 per t.).

Savings in Cordage Plant.—Internal transportation cost $50 per week. Two months after installation of industrial truck it was found that the truck saved $15 per week in labor and enabled 25 per cent more work to be handled than before.

Tractor Handling L. C. L. Freight.—Service on three 16-ft. (4.88-m.) platforms 900 ft. (274.32 m.) long; average haul, 880 ft. (268.23 m.). Tractor handled 65 tons (59 t.) per hour, displacing eighteen to twenty men, who averaged but 3.3 tons (2.99 t.) per hour under fair conditions. Energy required, 3.6 days, 10.75 hours each, 55 kw.-hr. On another platform a truck saved $1,048 per month by eliminating pushers.

Dock Service.—Two 2-ton (1.81-t.) trucks load and unload metals and carry freight, Pacific Coast. With old hand trucks one man made trip every five minutes with two crates salmon and loaded twenty-four crates per hour. Electric truck makes trip in 2.5 minutes, carries eight crates and on tests has loaded 192 crates per hour. Only one man is required on the truck. Electric truck handled 1770 cases salmon in three hours with four men loading and unloading.

Storage Baggage Truck.—Record of week's service:

Number of packages handled	7,570
Average weight per package, pounds	230
Total weight handled, tons	900
Average distance load was moved, in feet	900
Percentage of time truck was working	80
Number of packages delivered per working minute	3
Number different jobs worked on	30
Heaviest single load drawn by tractor, tons	12.5
Cost of operator, interest, depreciation and energy	$24.00
Cost of moving 1 package, 900 ft., in cents	0.33
Cost of moving 1 ton, 9 packages, 900 ft., in cents	3.00

Handling Miscellaneous Way Freight.—

Total tonnage handled by three trucks	41
Round trip, in feet	560
Number of men required in loading and unloading	10
Time required in loading and unloading, hours	5
Cost of labor at 30 cents per hour, $15, or per ton	$0.366
Total cost of upkeep, per day	$1.00
Total cost of handling, per ton	$0.38

Comparing hand trucking on miscellaneous way freight, 27 tons were handled on a round trip of 200 ft. (60.96 m.) by ten men in five hours, or at the rate of $0.555 per ton. ($0.608 per t.)

Saving per ton by electric truck, 17.5 cents (19.3 cents per t.), and latter covered 2.8 times distance of hand trucks.

Handling Bagging.—Three electric trucks carried 35.5 tons (32.2 t.) a round-trip distance of 1600 ft. (487.68 m.) in two hours, requiring eleven men; labor cost of total handling, $0.191 per ton. ($0.21 per t.). Similar installation handling by man power, round-trip distance of 300 ft.

(91.44 m.), 54.5 tons (49.5 t.) required fifteen men for three hours. Total cost, 24 cents per ton (26.46 cents per t.), saving 5.7 cents.

Pier Service.—Four men required thirty minutes to unload and transport by hand thirty-eight bags of cement 500 ft. (152.4 m.). With electric truck, two men required seventeen minutes to unload seventy similar bags and transport them 750 ft. (228.6 m.).

Textile Plant.—Industrial truck with two men delivers six full beams and returns with six empties in eleven minutes. Formerly required fifty-five minutes to do same work with hand trucks. With electric truck 5 barrels of cottonseed oil have been loaded by two men and moved 280 ft. (85.34 m.) in 2.4 minutes. Five men with hand trucks required double the time, owing to having to push each barrel at slow walk over uneven planks.

Savings in Manufacturing Plant.—A large manufacturing plant eliminated the services of twenty-eight two-wheeled warehouse trucks, one two-horse team, thirteen four-wheeled trucks, eight wheelbarrows and eighteen men by the installation of two industrial electric trucks.

Coal Handling in Mill.—In a New England mill plant the work of hauling coal from the pockets to the boiler room, which formerly required three men, is now done with one man operating a small self-dumping electric industrial truck at a cost of not over $3.75 per day, including the operator's wages, repairs, tires and electricity.

Saving Labor on Grade Haul in Mill.—In a Massachusetts textile mill five men were formerly required to transport the goods from the packing room to a storehouse across the street, using the old-fashioned hand trucks. It was necessary to haul these goods up a grade of 15 per cent for a distance of 25 ft. (7.62 in.) to cross the street, and an additional man was required as a pusher. One electric industrial truck displaced five men in this service.

Economies of the Electric "Stevedore."—At Savannah, Ga., cotton is moved across the piers by industrial electric trucks equipped with hoists and cranes, carrying it directly into the holds of the steamers. Two such trucks handle more cotton in a day than twenty freight handlers can accomplish manually. At the Bush Terminal, Brooklyn, the same cotton is placed in cars by battery-truck cranes, with electrical "spotting" of cars. At the mills it is taken from the cars by industrial electric trucks capable of entering the cars and hauled to storage and spinning rooms by the same means.

On the Cunard Pier, New York.—In handling macaroni in boxes six industrial electric vehicles performed work in nine hours which would have required twenty-four hand trucks. The cost of labor with the electrics was $21, while at current longshoremen's rates it would have cost $87.60.

The development of the electric tractor enables from six to twelve times as much work to be done with one man as could formerly be handled manually. A daily service of 20 to 30 miles (32.18 to 48.28 km.) is common with industrial electric truck units, and where a boosting charge is provided in the noon valley this mileage may be increased 25 or 30 per cent. Special mention should be made of the value of these equipments in hospital service as labor savers, since by their use hot meals can be delivered to patients in widely separated locations with little or no loss of warmth compared with the slow progress of manual distribution. As the war progresses there is certain to be an increasing opportunity for labor-saving service by these units in the care of the wounded at base and home hospitals, releasing labor for other important tasks without the slightest prejudice to the patients' welfare.

Competent authorities estimate that in the United States alone a grand total of 720,000,000 tons (653,000,000 t.) of goods yearly passes through the railroad freight and transfer stations. The present lack of system in handling this freight and the time lost thereby represent a yearly loss of more than $80,000,000. The advance of the industrial electric truck into its rightful field of service here will do much to reduce congestion of shipping areas and streets, cutting down demurrage charges, releasing rolling stock and vessels for more frequent service and economizing in labor.

SOME ECONOMIES EFFECTED BY MEANS OF ELECTRIC HEAT

Production Processes Have Been Shortened and Labor Has Been Saved by Electricity in Industrial Heating

BY A. F. ALLSOP

In a doll factory at Chicago three 39-kw. electric drying ovens have been installed to drive moisture out of doll heads and bodies after they had been molded from a plastic composition. This installation shortens the drying time from three or four days to one hour. The previous method used was air drying. It was impossible to use gas owing to explosive vapors given off from the plastic composition. Steam heat was out of the question on account of its inability to give sufficiently high temperatures. The installation of electric ovens eliminated the labor of eight girls. These girls were paid $7 per week each. Besides eliminating some of the labor and greatly shortening the processes of production, electric heat also gave a much better product.

In another factory engaged in making paper roofing an application of heat was necessary to join the ends of the paper passing through the process of manufacture. At first three tailors' irons were used for applying heat to the joint. With this process it was necessary to stop the machinery for five or six minutes while the irons were brought to the machine from a distance of 30 ft. (9 m.), placed on the joint and removed to their accustomed place. A home-made heating unit has replaced the irons. This consists of a large block of iron approximately 60 in. long and 12 in. wide (1.5 m. by 0.30 m.), kept at a constant temperature by electric heat. The joining operation consists of uniting the end of one roll of roofing material to the beginning of another in order to make a continuous strip passing through the machinery. This machinery occupies a space approximately 175 ft. (52.6 m.) long, consisting of various tanks containing liquids, hot tar, coloring liquid, and sand and gravel. Formerly when the roofing machinery was stopped for the joining operation the parts remaining in the hot liquid, coloring liquid or sand received a surface of this material, thus materially reducing the quality of the roofing, which consequently had to be sold at a lower price. The installation of the iron block described made it possible to complete operations without stopping the machinery. This contrivance, while it did not reduce labor charges, materially increased the production and also the quality of the goods. Three of these heaters are in use. Two are rated at 18.5 kw. and one at 16 kw.

A third installation which is proving quite successful is a 236-kw. conveyor-type oven about 80 ft. long. It is used for japanning automobile parts and supplanted gas equipment and is showing a consumption of 9 kw.-hr. per 100 lb. (45.35 kg.) of metal baked, and still better results are expected when workmen become more proficient in handling it. When the change from gas to electric heat was made the number of workmen required was reduced by six.

Why Hydroelectric Development Lags

With a Labor Problem, the Country at War, Conservation Highly Necessary and Nitrates Essential for Crops, We Should Demand Fair Legislation from the Congress of the United States

BY HUGH L. COOPER

IN AN argument a legislator was told "The law of supply and demand will defeat you." He exclaimed in reply, "Then I will repeal the law."

This article is written with the idea of showing that in the United States for the last fourteen years we as a people, in our attitude toward sane water-power legislation, have shown an ignorance of our own interests as lacking in intelligence as that of the legislator alluded to. That the law of supply and demand is fundamental and inexorable no one will thoughtfully deny.

All over the world to-day people are suffering because of the high cost of living. This high cost of living is the direct result of a shortage in food supply, and this shortage in food supply obtains because the law of supply and demand is out of balance. To bring up the supply of food the principal need is for more labor, and yet our labor supply is daily being reduced below normal by war demands and their attending destruction of labor. If, then, we can devise a method of sensibly increasing our labor supply, we are beginning on a sure foundation if we are trying to relieve the high cost of living.

The labor problem is undoubtedly the greatest problem confronting the world to-day, and our best observers of this question are beginning to see that only as labor and capital devise plans looking to a permanent betterment of labor can peace between the two become happily permanent. To bring about this peace labor must work efficiently and labor must be conserved and used in a manner producing the greatest good to the greatest number. About the only commodities we can sensibly ignore in a campaign for efficiency are air and salt-ocean water.

WATER POWERS CONSERVE LABOR

The writer will endeavor in what follows to set forth the claim that the harnessing of our water powers will conserve more labor and produce better living conditions in the United States than can result from any other agency or group of agencies that can be mentioned by the anti-water-power development crowd, who for the last fourteen years have labored so successfully in the use of misrepresentations to kill the water-power industry in the United States. Facts are almost always uninteresting reading, and the public at large is generally unwilling to stick to even one page of facts unless the public is hungry.

Secretary Lane has recently said that there is in the United States 35,000,000 water horsepower undeveloped. The attacks on water-power engineers and developers began in 1903, and since that time the aggregate falling off in water-power development amounts to more than 5,000,000 hp. In other words, if water-power development had been encouraged during this period and continued at the normal rate of development prior to 1903, we should have an additional 5,000,000 hp. at work to-day and the public would be fixing the rates to be paid for this great additional amount of energy. The consumers would be enjoying a saving of at least $50,000,000 annually in their power bills, and, most important of all, as will be shown later, 100,000 laborers now engaged in following coal from the bowels of the earth to the ash pile would be free for other more important work.

In addition to the foregoing, the development of this 5,000,000 hp. would have been of great benefit to our farmers, because of the cheap fertilizer it would have produced. Besides this, about $274,000,000 worth of railroad equipment now hauling equivalent coal would be available for other most important and crying needs. But the "conservationists" decreed otherwise and the waste goes merrily on.

CALL LABOR AND CAPITAL TO SERVICE

This is a fine price we are paying for following during the last fourteen years the proposals of impractical, uninformed, though probably well-meaning, men who have no intimate knowledge of our industrial life and the responsibilities related thereto. In this hour of the world's greatest trial the S. O. S. calls are now directed in the main to laboring men and to the great industrial organizations commonly called corporations. If our country is saved, it will be these two great elements that will achieve the result, aided by our men of finance and by the engineering profession, rather than by those whose principal job is talking loudly about matters they have been fooling and bulldozing the people about for a long time in the past.

The war should bring capital and labor nearer together in the future and so enable them to conserve our resources and help one another for the common good, and thus make us yearly more immune from the cranks in and out of our legislative bodies.

Much has been said in the past about conserving our coal. More important to-day, however, is the need to conserve our labor. The following analysis will be interesting to those who realize that conservation of our labor is important, first of all to labor itself and second to the public at large.

Let us therefore see what the government statistics reveal regarding this question, taking the 35,000,000 undeveloped water horsepower given by Secretary Lane as the basis. The government statistics available are for the year ended June 30, 1914, and for bituminous coal production for the year 1915.

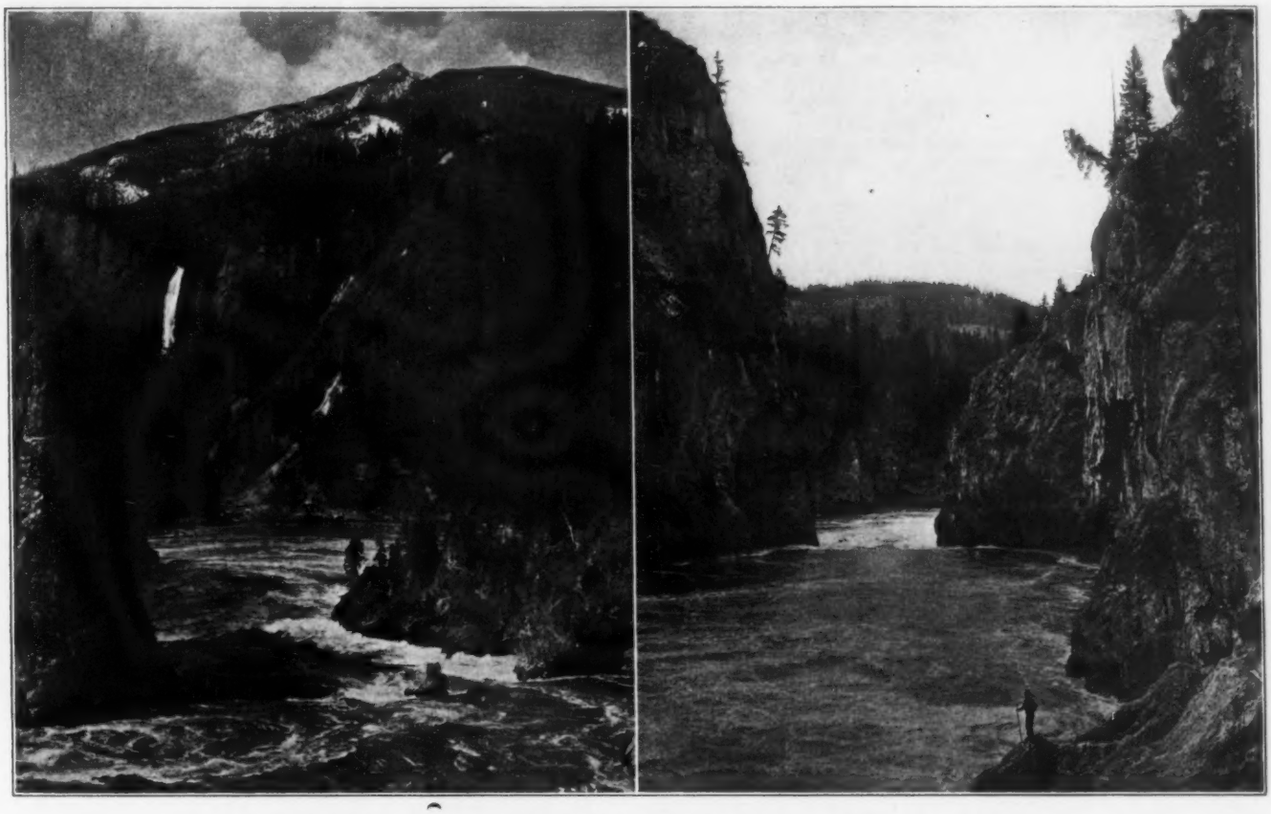
SAVING IN LABOR

During 1915 442,000,000 tons of bituminous coal were mined, requiring the employment of 557,000 miners, from which it is apparent that the mining of coal is at the rate of 1.26 employees per annum per 1000 tons of coal mined. Of the above quantity of coal mined, approximately 380,000,000 tons were shipped on cars and required the use of about 800,000 gondola cars and

20,000 locomotives, and in the way of labor in all of the branches of the railroad serving the movement of this freight there were required approximately 388,000 men; hence for every 1000 tons of coal transported the services of 1.02 men were required to work a year.

This coal finally landed in the ash pile, and we find from statistics relating to employees in central steam stations that for every 1000 tons of coal consumed there were required the services of half a man for one year. Therefore the total labor required for the consumption of every 1000 tons of coal on the basis of one year's time is 2.78 men.

To transport 280,000,000 tons of coal there are required among other things 600,000 freight cars that cost about $1,200,000,000 and 20,000 locomotives that cost about $400,000,000 more, and if we add to the above figure other financial expenditures that are necessary so that the freight cars and the locomotives can do their work, we have as a result around $1,920,000,000 of our railroad investment employed in the hauling of a commodity that could be dispensed with entirely and this great amount of equipment employed in the transportation of our farm products, certainly at a less cost than now obtains.



ONE OF THE HUNDREDS OF UNDEVELOPED SOURCES OF WATER POWER IN THE WEST

On the average, 1000 tons of coal in the United States produces 125 hp. for a year of time; 35,000,000 water horsepower developed and in commission would save the necessity of mining 280,000,000 tons of coal per annum. As regards labor this vast tonnage requires for its production, transportation and consumption 280,000 × 2.78 men, or 778,000 laborers of one kind and another. The amount of labor required to operate this 35,000,000 water horsepower may be put conservatively at 40,000 men. Therefore the net saving in the way of labor alone by the installation of this water horsepower would be approximately 740,000 men available for other industries.

The above figures brought down to a statement that can be easily remembered amount to this: Every time 50 hydroelectric horsepower is developed and put in commission one laborer is permanently released for other uses.

The foregoing figures are of themselves of great moment with respect to the saving of labor, but there is still another tremendous conservation that has directly to do with the cost of food and to the cost of many other needs of life.

The spectacle of hauling 280,000,000 tons of coal (35,000,000 hp. at 8 tons per year per horsepower) over our railroads each year when we could avoid so doing in a perfectly practical way is just as foolish as would be a proposal to make the railroads haul the salt water of the ocean on cars to interior points and there evaporate it for the salt it contains instead of using as we do the natural inland salt deposits.

Power in all its forms in the United States has been steadily going downward in cost for many years, yet in spite of this the average selling price of hydroelectric power is about $10 per horsepower per annum less than the price of the same unit by steam.

The crops in France, in England, in Germany and in the United States are all suffering to-day from want of fertilizers. Volumes have been written showing that fertilizers, intelligently used, would about double the present farm production of the United States. The primary basic need of fertilizers is nitrogen, which can be most economically produced by the arc process from the air. We are the only large country in the world where fertilizers by this process are not in successful use.

Page after page could be filled with the enumeration of other blessings along the same lines that are now denied our community because of lack of water power, and in this category could be included wide benefits in the way of reduction in the cost of news-print paper instead of the maintenance of a monopoly therein as is now the case because no new water powers are being developed.

DIRECT ECONOMIC SAVING

Let us now "sum up" the above direct economic values that the construction of 35,000,000 hp. from water would produce:

Annual saving to consumers, 35,000,000 hp., at $10..	$350,000,000
Annual interest and depreciation on $1,920,000,000 worth of railroad property needlessly employed, at 8 per cent.....	153,600,000
Annual production along other lines due to the labor of 738,000 men, assumed at $1,000 per laborer....	738,000,000
Total	$1,241,600,000

In other words, we are following a program that is absolutely wrong relating to $1,241,600,000 annually of our business life, to say nothing of the reductions in the cost of food if every State in the Union could be provided with fertilizer factories for the furnishing of fertilizers that the farmers need to increase greatly the production of the farms and correspondingly reduce the cost of living to all of our people. How can we claim as a government even moderate intelligence in the face of a misfit in our industrial methods because of which we are going wrong respecting $1,241,600,000 yearly? Private business so conducted could not survive.

If the reader has arrived thus far in this discussion, the very first question he will ask will be, "What is the matter and why don't the engineers and the bankers develop our water powers?"

The answer is that there is no law now on our federal statute books that will permit of a dollar of investment in water powers if the investor demands safety. Revocable permits, subject to cancellation at the will of any politically ambitious cabinet officer, are offered in the way of security of tenure for those trying to bring about development on public lands, and on navigable rivers there is no authority at all. Much the largest element in the cost of developing water power is interest on the investment, and this interest rate, in the interest of the consumer and the investor, should be kept as low as possible.

When we consider that the construction of dams and hydroelectric work generally is undoubtedly the most hazardous of all of our industrial undertakings except possibly powder manufacture, and then when we come to add to the exigencies of construction the uncertainty of tenure, we find an amount of risk which first of all is not in the interest of the consumer and secondly forbids construction.

HOW TO DO IT

The government can remove the risk incident to the question of tenure by giving the water-power companies fixed tenure for fifty years and at the end of fifty years agreeing to extend the tenure for a further term upon a mutually satisfactory basis, or, failing in this, take the property over on payment of its fair value at the time the property is taken over, excluding franchise and other values granted by the government. The final and equally important requisite of law would be that these water powers should have the service they render and the prices they charge both regulated by the state public utility commissions of the states in which the power is consumed.

The reader will be surprised to know how easily, by the passage of fair legislation, the resumption of water-power development can be brought about. If he wants to learn of something really difficult instead of simple, let him talk to the few Congressmen and Senators—not more than 5 per cent of the entire representation—who have for years kept the Congress from passing constructive water-power legislation. Their claim has been that our water powers are to be grabbed and stolen from the people, but they have no facts or reasonable assumptions to support this claim, and when challenged, as they have been time after time, to bring forward sound reasons for their position, they have always failed.

The fact that absolute regulation of rates and service is asked for by the water-power people, which in itself fully protects the public, is brushed aside. We successfully regulate our railroad rates and service and could in the same intelligent manner regulate our water powers and in this way protect the public and encourage development.

TIME FOR THE RANK AND FILE TO AWAKE

Statements attacking capital, for some reason or other, make about a thousand times as much impression as can possibly be created by stating the simple unanswerable truth in reply thereto; and until the people generally realize the gravity of this entire situation we shall go right along allowing the present penalties to accumulate until startling necessities make the rank and file wake up and demand of the government encouraging laws for the development of an industry that can do more for them than any other single branch of our industrial life.

SLAG PREVENTIVE FOR FLAME-ARC LAMPS

Boracic Acid Prevents Formation of Slag in Flame-Arc Lamps—Amount Needed Depends on Salt in Positive Electrode

Boracic acid, it has been found, prevents the formation of slag in arc lamps more effectively than borates or other salts of alkalis and also makes the light of the arc steadier. The advantage of boracic acid is found to be particularly great in open-arc lamps, whereas in inclosed-arc lamps the resulting advantage is less marked. It has, moreover, been found that the beneficial action occurs only when the amount of the admixture exceeds a certain limit, depending on the percentage of salt in the positive electrode. The correct proportion must be found experimentally in each case. For example, when positive carbons are used containing about 30 to 40 per cent of luminous salts it has been found that about 3 to 5 per cent of ordinary boracic acid is required, according to the nature of the luminous salts in each case, or a correspondingly smaller quantity when the anhydrite is employed. An invention to this effect has been claimed by Georg Egly, assignor to Messrs. Siemens Brothers & Company, in patent No. 1,221,039.

Legal Requirements of Factory Lighting

Need of Expressing Lighting Specifications in Simple Terms That Can Be Readily Understood and Enforced—Too Much Legislation Not Desirable —Difficulties in the Way

BY C. E. CLEWELL

Assistant Professor of Electrical Engineering, University of Pennsylvania

SUMMARY.—Progressive industries look upon adequate light as an economic necessity, and it is only for those cases where lack of information or lack of progressiveness causes certain manufacturers to lag behind that legislation becomes necessary. In this article brief reference is made to the efforts of the Illuminating Engineering Society to promote intelligent legislation and to the contents of its typical code. In addition, the regulations now in force in Wisconsin and New York are contrasted with the new factory lighting codes which became effective in 1916 in the States of Pennsylvania and New Jersey. The importance of such regulations is brought out by a quotation from a commissioner of labor in one of the States foremost in the enactment of such rules. The author comments on the problem of enforcing these codes, and, to show that the present regulations are not a hardship, he compares the minimum requirements of representative State codes with actual cases of good lighting practice.

THERE is little or no call for legislation to enforce minimum standards of factory lighting in industries which appreciate the economic value of good light. The best evidence perhaps of the truth of this statement is the fact that the working illumination intensities in many well-lighted factories are considerably higher than the minimum requirements of the latest state factory lighting codes. In Fig. 1, for example, the minimum requirements for rough and for fine manufacturing work in the 1916 Pennsylvania state code are contrasted with actual intensities of illumination as measured in a number of lighting installations within the State which were in service before the code became effective and even before it was drafted.

Many other cases are to be found, however, where manufacturers have lagged behind in grasping the fundamental ideas of good light as an aid to production, or where ignorance of the advances in the art exist. It is mainly for the purpose of causing such operators to keep their lighting facilities above a desirable minimum that legislation in one form or another may be looked upon as a need.

TOO MUCH LEGISLATION NOT DESIRABLE

As a general proposition, too much legislation for the industries is unfortunate, since it unduly complicates the conditions surrounding the manufacturer. In the case of lighting many fragmentary and unsatisfactory enactments have been on the statute books of various states for years. However, some work has been conducted on the part of several states to draft more comprehensive regulations to govern factory lighting. In view of lighting legislation becoming more general, persons who are qualified and able to do so are fully warranted in making an effort to see that such regulations when enacted are adequate and definite for the purposes they are intended to cover.

Fundamentally this service or duty is the basis for the efforts which are under way, and which have been made for several years by the committee on lighting legislation of the Illuminating Engineering Society. This committee has sought to assemble the best ideas available on the subject, and with this task accomplished intends offering its services to those commissions which may plan to undertake drafting rules of this kind. In its work this committee has made an examination of the regulations which apply to lighting in a number of states. This examination shows conclusively that most of the efforts in this direction in the past have been ineffective, if not actually worthless. Among the reasons for the ineffectiveness of the rules are their indefinite nature and the impossibility of placing upon them a specific interpretation, which must obviously precede enforcement if justice to those affected is to result.

WHY LIGHTING LEGISLATION IS NEEDED

That there is a real need for such legislation is made apparent by the results of actual tests of lighting systems where the intensities are far below the minimum values dictated by good practice for such work. Thus, in Fig. 2, the minimum values of intensity in the new Pennsylvania code are again shown by the horizontal lines for rough and for fine manufacturing work, while the points of the irregular line show the actual measured intensities in a number of poorly lighted factories within the State. The voluntary decision on the part of progressive manufacturers that light is needed in the quantities evidenced by Fig. 1 is a condemnation of the unprogressive class of industries for forcing their employees to work under the low quantities of illumination shown by Fig. 2. Taken together, therefore, these two diagrams indicate that the effect of legislation on the class of industries represented by Fig. 2 can hardly be other than a benefit.

Lighting legislation is the past has in nearly all cases consisted in the specification that the light shall be adequate or suitable or proper. Such modifying terms are, of course, indefinite and subject to different interpretations by factory owners and state inspectors. To determine whether lighting conditions are adequate or suitable depends on the personal judgment of the person on whom the decision rests. For many reasons, therefore, it cannot be classed as legislation which will result in maintaining a certain standard of illumination for any particular class of work. One merit which may be justly claimed for these older forms of regulation is that they at least called attention to the necessity for light. Aside from this, they show by their negative practical results that in effect they are of little or no value.

One of the first problems, therefore, which confronted the committee on factory lighting[1] in the preparation of a typical code was that of drafting specific rules in

[1]On which the writer served as chairman. This committee was appointed late in 1914 by the Illuminating Engineering Society.

such a manner that they could be readily interpreted, definitely understood and easily enforced. There is, of course, quite a variety of ways in which the specification of quantity may be made. One of the common schemes in earlier practice was to specify the watts per square foot of floor area. This is a readily understood term and is one which can easily be checked on a basis of the lamp ratings and the floor space lighted.

The obvious fundamental difficulty in the use of the watts per square foot as a basis of specification is illustrated in a striking manner by Fig. 3. The values of this factor are shown graphically for seven different lamps and for the same intensity at the work in each case, it being assumed in calculating these values that 40 per cent of the total generated light flux is effective on the working area in each case. From Fig. 3 it may be noted that the wide differences in the values of the watts per square foot to produce a given intensity are due to the differences in the ratings of the lamps in lumens per watt. Thus the use of carbon-filament lamps, because of their low flux per watt, requires a much greater watts density per unit of floor area than the metallized-filament or tungsten lamps, which produce greater quantities of flux per watt in each case.

Furthermore, owing to the variation in the ratings of different sizes of lamps of a given type, the watts per square foot required for a given intensity would change for various sizes or styles of units of a given type. This is well illustrated by the differences in the lumens per watt rating for the various sizes of vacuum and gas-filled lamps. The assumption that 40 per cent of the total generated flux is effective on the working surfaces is based on the condition that there is an efficient distribution of the light in useful directions from the lamp, and on certain ceiling and wall-surface conditions, variations in which would again make it necessary to modify the watts-per-square-foot value.

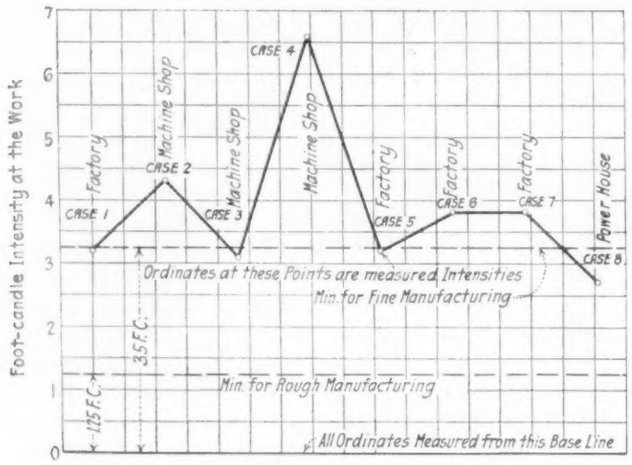
For numerous reasons, therefore, any specification which applies to the lamp directly and which at the same time attempts to specify the quantity of light on the work must take adequate account of all the variables which enter between the light sources and their effective illumination on the work. Because of the many uncertain factors a specification of this type is likely to result in a cumbersome scheme that will often be difficult or even impossible to reduce to a definite basis. As stated before, however, the use of this factor has the advantage that the two elements—watts consumed per lamp and the floor area—are in themselves easy to understand and to determine.

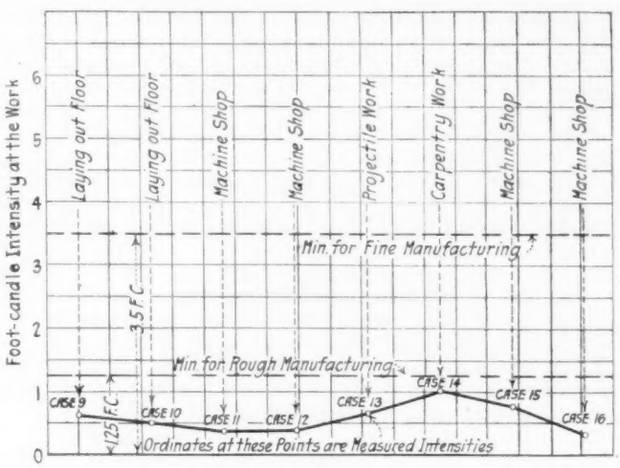
Candlepower per Square Foot

Other factors applying to the lamp might be employed in a manner quite similar to the use of the watts per square foot as a basis of specification. For example, the number of lamps to install for producing a certain intensity might be based on the mean spherical, the mean lower hemispherical or the mean horizontal candlepower, or on the total generated lumens per square foot of floor space in each case. All of these factors are open to much the same objection that has been pointed out for the watts-per-square-foot factor.

To show what specification by these schemes amounts to, the following values have been worked up for use with 100-watt vacuum tungsten lamps on a basis of a rating of 10 lumens per watt, a utilization efficiency of 40 per cent and an intensity of 4 ft.-candles at the work.[2] Thus, for this particular utilization efficiency the specification might take the form of 1 watt per square foot, 0.8 mean spherical candlepower per square foot, ten generated lumens per square foot, or about one mean horizontal candlepower per square foot. From these values it is obvious that to use a specification of candlepower per square foot it is essential to state whether this refers to the mean spherical, the mean lower hemispherical or the mean horizontal values.

The Wisconsin shop-lighting orders,[3] issued in January, 1913, constitute an example of legislation which makes use of a candlepower per square foot specification. One of these orders (No. 2102) will illustrate this point. This order, which refers to artificial light where there is no gas or smoke, reads: "Each place of employment in which hand or machine operations are performed must be supplied during the working hours, when daylight is not available, with artificial light





FIGS. 1 AND 2—ILLUMINATION INTENSITIES MEASURED IN DIFFERENT INSTALLATIONS

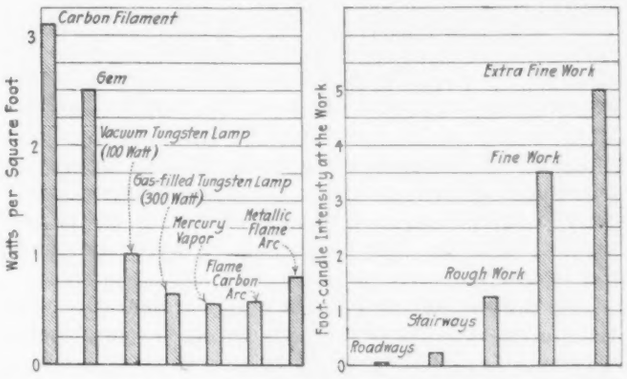
The irregular line of Fig. 1 refers to installations where fine work is being done, and that of Fig. 2 to places where rough work is being performed. The horizontal broken lines indicate the minimum illumination intensities specified by the new Pennsylvania code for fine and rough manufacturing.

[2] The utilization efficiency of a lighting system is defined as the ratio of the effective lumens on the working surface to the total generated lumens of those lamps lighting the surface, expressed as a per cent.

[3] It should be noted that plans are now under way for making a complete revision of the original Wisconsin orders.

equivalent in amount for each 4 sq. ft. of floor space to not less than the light produced by a 1-cp. lamp hung 10 ft. from the floor."

This order has the objection that it does not specify what kind of candlepower is referred to—that is, whether mean spherical, lower hemispherical or horizontal—and is further open to the disadvantages of any of the methods which refer such a specification back to the lamp. In brief, there is no assurance that a lighting installation which conforms to such an order will be what was intended by those who drafted the regulation. However, with this basis as with the watts-per-square-foot specification the candlepower is a term which can be grasped quite readily by the practical man to whom the code specifically applies.



FIGS. 3 AND 4—UNIT POWER REQUIREMENTS WITH DIFFERENT TYPE LAMPS, AND ILLUMINATION REQUIRED FOR DIFFERENT PURPOSES BY NEW JERSEY AND PENNSYLVANIA CODES

The requirements indicated by Fig. 3 are based on securing the same illumination intensity in each case, 4 ft.-candles having been selected as the intensity at the work and 40 per cent as the utilization efficiency.

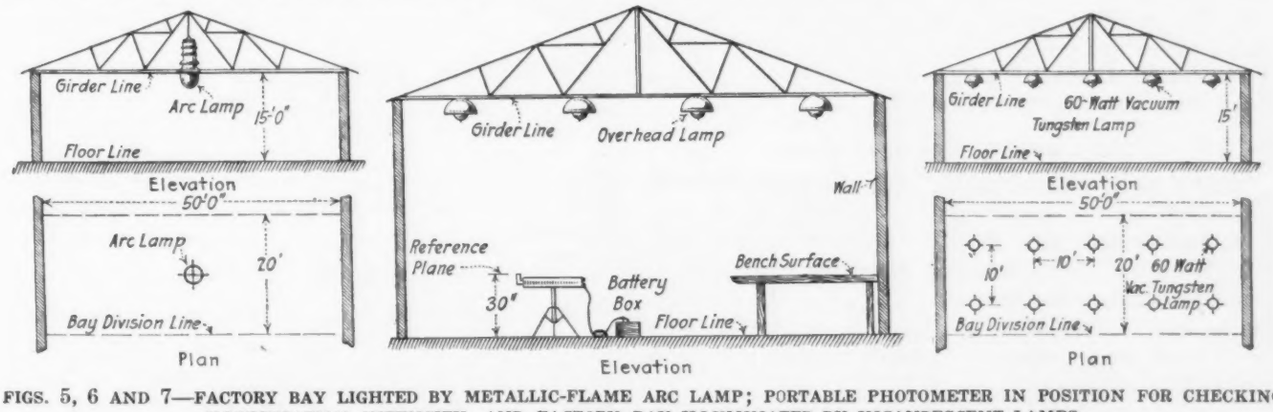
SPECIFICATION OF INTENSITY AT THE WORK

The most obvious improvement over the foregoing methods is to specify the intensities of illumination at the work for various manufacturing operations in terms of the foot-candle. This plan, however, has three fundamental disadvantages from a practical standpoint—first, it makes use of a unit (the foot-candle) which is not generally grasped and which is difficult to understand; second, the quantities of illumination for various operations, as at present understood, are largely arbitrary—that is, not determined on a scientific basis; third, to check up such rules requires measurements with instruments which in general are not well adapted to the every-day use of a factory inspector upon whom rests the responsibility of passing upon the factory lighting conditions.

Notwithstanding these difficulties, the use of foot-candle intensities at the work forms the basis of the Illuminating Engineering Society's code,[4] which was issued late in 1915. This code, in its essential features, has since been adopted by the States of Pennsylvania (effective on July 1, 1916) and of New Jersey (effective on August 1, 1916). Fig. 4 shows graphically the minimum requirements in the foot-candle intensities for various classes of work as listed in these new codes. The accompanying table also furnishes a convenient means for comparing the minimum and desirable intensities in the various codes with those dictated by good practice from other sources.

TWO CODE REQUIREMENTS ILLUSTRATED

To illustrate differences in two of the present codes, Figs. 5 and 7 refer to lighting plans for a given bay based (in Fig. 5) on order No. 2102 of the Wisconsin orders and (in Fig. 7) on the specification for rough work in the Pennsylvania and New Jersey codes. The use of a single arc lamp (Fig. 5), while a very poor arrangement, may, in a general way, be said to fulfill the Wisconsin order, since the 4-amp. metallic-flame arc lamp produces 250 mean spherical candlepower for 1000 sq. ft. of floor area, or 0.25 mean spherical candlepower per square foot. The illumination from a single arc lamp at such a low height is likely to be far from uniform on the working surface and the glare very objectionable. Fig. 7, on the other hand, shows a plan designed to furnish a uniform intensity of 1.25 ft.-candles on the working surfaces, in accordance with the minimum requirement for rough manufacturing in the Pennsylvania and New Jersey codes. The superiority of Fig. 7 over Fig. 5 is obvious, and yet each conforms to the minimum requirements for rough work in given states.



FIGS. 5, 6 AND 7—FACTORY BAY LIGHTED BY METALLIC-FLAME ARC LAMP; PORTABLE PHOTOMETER IN POSITION FOR CHECKING ILLUMINATION INTENSITY, AND FACTORY BAY ILLUMINATED BY INCANDESCENT LAMPS

Figs. 5 and 7 represent the same bay (floor area, 1000 sq. ft.), illuminated in one case by an arc lamp and in the other by incandescent lamps. With the 4-amp., 250-cp. (mean spherical) metallic-flame arc lamp the illumination obtained in Fig. 5 would meet the Wisconsin code requirements now in force—that is, 1 cp. per 4 sq. ft. of floor area—but the lighting would be unsatisfactory. Vacuum-type tungsten lamps rated at 60 watts each and arranged as shown in Fig. 7 meet the Pennsylvania and New Jersey requirements of 1.25 ft.-candles. The utilization of efficiency assumed is 27 per cent.

No similar comparison diagrams can be given to include the revised New York regulations, issued in proposed form in 1913, because they do not contain speci-

[4]Fully discussed by the writer in the ELECTRICAL WORLD, Vol. 66, No. 21, p. 1135, under the title "A Code for Better Industrial Lighting." A revision of this original code is now under way.

fications of quantity. These New York rules were drafted at that time expressly for minimizing abuses of eyesight by the use of unshaded lamps, no attempt having been made to include definite specifications of any kind. It should be noted that the effort to reduce the most apparent evils of bad lighting, even without the more definite specifications of quantity included in later regulations, made this New York bill an improvement over much of the existing lighting legislation at the time. The latter in nearly all cases was limited to such general modifying terms as "adequate" and "proper," which, as previously stated, are so indefinite as to be of little or no practical use.

Need Felt for Improved Legislation

One indication of the need which has been felt for improved rules to govern industrial lighting has been the attitude of the commissioners of labor in those States which have taken the greatest interest in the subject. As an evidence of this attitude, the following comment[5] on the part of a State commissioner of labor is of interest:

> "Why shouldn't a workman be expected to have proper light, the same as proper air to breathe? If he is forced to work in an improperly lighted workroom or where the light is shining in his face, as I have seen in factories, why isn't that just as much an injury, by reason of his occupation, as having his finger cut off, for instance? It may be very much more serious to him; it may be a very much greater handicap in his occupation during future life. . . . What surprises me is the absolute lack of intelligence on the part of so many good manufacturers in the use of light. They do not know anything about it. I have often explained to the factory inspectors that the mere use of a piece of paper to screen lights from the eyes would often constitute splendid work. I believe that this matter should be taken up in the form of scientific standards and that these standards should be expressed in language which the ordinary layman will understand."

In addition to the foregoing comment, it should also be noted that the Industrial Commission of Wisconsin, through its deputy in charge of lighting, has in hand at this time a complete draft of a revised set of lighting rules which are proposed as a substitute for the older and somewhat unsatisfactory shop lighting orders issued early in 1913 and still in force.

The Problem of Enforcement

The recently enacted codes, with the specification of intensities at the work, present a number of more or less difficult problems in their practical enforcement. The tendency of the casualty insurance companies to penalize with higher premiums the poorly lighted factories will be helpful as an influence, and particularly so in those States where workmen's compensation laws are rigidly enforced.

It is obvious, however, with every good intention on the part of manufacturers to live up to the requirements of a code, like that, for example, in Pennsylvania and New Jersey, that the check on an intensity of illumination on a working surface is not a simple matter like the check on watts per square foot or even that of candlepower per square foot. Illumination intensity is not susceptible to an accurate and often not even to an approximate determination by the eye, and hence both of the recent codes specify that for purposes of measurement a horizontal reference plane 30 in. above the floor is to be taken and a properly standardized portable photometer or illuminometer used. This means, of course, a check by an instrument somewhat as suggested by Fig. 6, and this immediately suggests the need for simple and inexpensive devices for measuring intensity, without which the problem of enforcing such rules is sure to be more or less unsatisfactory.

In this connection it may be suggested that manufacturers in States with industrial lighting codes would do well when purchasing new lighting equipment to require the lamp manufacturers to furnish specifications to govern the installation of lamps, with a guarantee that if they are installed according to these specifications they will provide an average illumination intensity in keeping with the requirements of the code applicable to the class of work to be performed under the lamps.

There does not seem to be any fundamental objection, as regards the way of conducting the enforcement of such rules on the part of State boards, to having a list of accredited lamp manufacturers from whom a guarantee that certain requirements are fulfilled by a new lighting system may be accepted without further check by inspectors other than a general inspection. With old installations the problem could not, of course, be solved so readily.

ILLUMINATION INTENSITY REQUIREMENTS IN FOOT-CANDLES IN VARIOUS CODES AND BY DIFFERENT AUTHORITIES

Class of Work	Clewell's "Factory Lighting," 1913	G. E. Co.'s "Handbook on Lighting," 1913	Wisconsin "Orders," [1] Minimum, 1913	I. E. S. Code of Lighting, Minimum, 1915	British Report, [2] Minimum, 1915	Pennsylvania Code, 1916		New Jersey Code, 1916	
						Minimum	Good Practice	Minimum	Good Practice
General lighting	....	0.08	....	....	0.25	....	.....	....	.....
Yards, roadways, etc.	....	....	....	....	0.05	0.05	0.05 to 0.25	0.05	0.05 to 0.25
Stairways, etc.	0.50	0.50	....	0.25	0.10	0.25	0.25 to 0.50	0.25	0.25 to 0.50
Foundries	....	3.00	1.50	1.25	0.40	1.25	1.25 to 2.50	1.25	1.25 to 2.50
Rough manufacturing	3.00	2.00	0.75	1.25	....	1.25	1.25 to 2.50	1.25	1.25 to 2.50
Fine manufacturing	5.00	5.00	1.50	3.50	....	3.50	3.50 to 6.00	3.50	3.50 to 6.00
Extra fine work	....	....	....	....	....	5.00	10.0 to 15.0	5.00	10.0 to 15.0

[1] The intensities in this column have been estimated from the specifications of candle-power per square foot as listed in the original Wisconsin orders.

[2] In the 1915 British report no recommendations are made concerning the illumination required for the work, and hence the intensities specified in this column are merely given for general illumination, without regard to the needs of the work itself.

Other Requirements

Other items are included in these new codes in addition to the quantity specifications, which are also most important. One of these is the rule against glare from unshaded lamps. To reduce the question of glare to a simple measurement suitable for inspectors is another difficult matter. Suggestions have been made looking to such a measurement, but as yet no very satisfactory scheme has been advanced. From the viewpoints of both State labor commissions and manufacturers cooperation is required in a special manner during these transition years, when the change is being made from old and indefinite statutes to these recent codes with their more definite regulations, so that regulations may be introduced which will not complicate enforcement.

[5] Discussion by Col. L. T. Bryant, Commissioner of Labor in New Jersey, found in *Transactions*, Illuminating Engineering Society, Vol. XI, No. 1, pp. 65, 66. Abstracts from Colonel Bryant's notes.

Working Toward Saturation in Thirty-two Towns

An Interesting Development in Central Station Salesmanship in an Iowa Territory—Methods of Soliciting That Were Employed and Summary of the Results That Followed

BY ARTHUR HUNTINGTON

New-Business Manager Iowa Railway & Light Company, Cedar Rapids, Iowa

THE Iowa Railway & Light Company, with headquarters in Cedar Rapids, operates at present in thirty-two Iowa towns and cities with a range in population from 40,667 down to 125 according to the local census figures of 1915. In this total population of slightly more than 100,000, which can be reckoned as about 30,000 homes, the company is serving at the present time over 22,000 customers. Rather more than 4000 of these consumers have come on the lines since the house-wiring month of 1916. At the time when the writer became new-business manager of the company, the territory had already about twenty customers connected for each hundred people, and the impression seemed to prevail that the market had been combed to the limit. The staff consisted of one experienced salesman, one inexperienced salesman and a small wiring department. House-wiring month was right ahead, and it was decided that the first thing to do was to organize a wiring campaign.

On account of the present high price of material it was deemed advisable to select that form of business which called for as small an outlay of money as possible. It was decided to confine our efforts to wiring old houses along the company's lines, limiting extensions to one pole and one span of secondary construction, plus a service drop. The following scale of prices was adopted, all jobs to be complete, ready to burn, with lamp inspection paid for by the company and free energy for one month:

STANDARD SCHEDULE

Three rooms complete with lamp drop and lamp ready to burn, complete with entrance and meter loop	$10.00
Four rooms, same as above	12.00
Five rooms, same as above	14.00
Six rooms, same, one floor	16.00

ADDITIONS

Sockets, pull chain	0.25
Shade and holder	0.15
One light fixture, with lamps and shades	1.00
Two light fixtures, with lamps and shades	3.00
Three light fixtures, with lamps and shades	4.00
Hanging fixture while man is on job	0.50
Hanging fixture where special trip is necessary	1.00
If fixture does not replace drop cord, add	0.50

SWITCHES

Snap	2.25
Flush	2.75
Snap three-way	5.25
Flush three-way	5.50
Basement light snap switch	4.75
Additional light on same circuit	1.50
Attic light snap switch	2.75
Porch light snap switch with 40-watt lamp and bowl	4.75
Porch light flush switch	4.75
Iron outlet in kitchen with key wall receptacle	3.50
Taking up floors over six rooms	2.00
Each additional drop	2.00

It was decided to work entirely on schedule without regard to whether the houses were easy or hard to wire. The whole campaign was planned before a man was sent out, bearing in mind that our men were inexperienced and that the results desired were the development of one particular branch of the business, and only a few changes have been made from that day to this. The cardinal points of our plan were as follows:

CARDINAL POINTS OF PLAN

1. A price within the reach of all. In fact, the whole basis of our advertised figures was to interest the small home owner, and no figure was used that was excessive The figures for the simplest kind of a job were very low, but the extras such as fixtures, switches, etc., were figured at a good profit and made the wiring as a whole pay.

2. Conservative and good advertising. We presented the whole plan to the people through the medium of the daily and weekly press.

3. A good wiring department kept busy. The jobs were given to the wiring department in such numbers that they could be handled on a wholesale basis. By keeping a man on the same class of work all the time he was able to become very proficient, and in a short time we found that our cost of labor per outlet had been almost cut in two. The men always had a job to go to and were never permitted to leave a job until it was completed.

4. A soliciting force well directed, working with a unity of purpose backed up by the office.

The writer has always found it more advisable to develop his own men rather than to hire men of experience from other companies, but as time was short he sent for a man that he had schooled in another property and began looking for some men to develop. Two men were selected, one a wire man who had worked in a carhouse as repair man but had had no soliciting experience, and later a young man who was driving a bread wagon for a bakery. This last man was selected for no other reason than that he could talk Bohemian, there being a large Bohemian population here.

The men were paid at the rate of $2 per customer, together with railroad fare both ways from headquarters to the town under canvass, with instructions that they were expected to make at least $150 per month. They were instructed to take each house in town in rotation without regard to whether it was a big house or a small one. They were not permitted to go after "prospects" off the regular route chosen. If one of them heard of a specially good prospect, he was supposed to get the order when he arrived at that house. Incidentally a surprising amount of business was closed after supper. It figured fully 60 per cent of all business in the winter time and as high as 75 per cent in summer.

Our very first efforts were crowned with success, and with an average of four men working we secured on the Iowa Railway & Light property 3861 customers by the end of the year and at the same time secured on the Iowa Electric Company's property (a subsidiary) about 685 more. We loaned one solicitor to wholesale

towns, where he secured forty-one customers. One solicitor secured twenty-eight contracts a week straight through the year, and another, a man who had never solicited previously, twenty-seven customers a week.

At Belle Plaine eighty-nine contracts were secured by one man in nine days. At Nevada another man secured seventy-seven contracts in six days. The men worked strictly on the schedule above referred to. The cost of securing a contract on the average was $2.22 for soliciting, and the gross selling expense was $5.04. The average profit per job from the wiring department has been $4.26, which goes a large way toward paying the overhead expenses of securing and connecting new business.

To give some idea of how closely we confined ourselves to the existing lines, it need only be said that the average amount of service and secondary copper per customer was 13 lb., while only 104 poles were set to connect up 3861 customers, most of these being used in crossing streets. Meanwhile 112 customers were rejected for being off the line and sixty-four on account of credit. None of this shows in the records.

The men of the wiring department entered into the spirit of the campaign so enthusiastically that, working without a boss miles from headquarters, they established a standard of an outlet an hour, in and out of town, which included hanging fixtures—in fact, completing the job.

The result of the year's work shows up conclusively in the following statement comparing the activities of the wiring department in 1916 with results in 1915. This, of course, does not touch in any way the large amount of other work done by the local contractors.

	1915	1916
Total sales expense	$16,153.57	$22,588.98
Total customers	2,323.00	*4,448.00
Cost per customer	7.05	5.04
Jobs handled by Iowa State	1,353.00	3,320.00
Gross business	19,897.79	52,447.21
Profit of Iowa State Electric Company	1,106.70	14,863.17

It will be noted in the 1916 report that this statement shows that we gained 4448 customers during the year. This figure is correct, but about 600 of these customers this department is in no way responsible for, which accounts for the discrepancy between 3861 customers previously claimed and 4448 customers.

While the prices in our schedule seem rather low, we made money in spite of the high price of material by utilizing our force so constantly and keeping our workmen busy at all times. At one time we were over 500 contracts ahead of a wiring department that was capable of handling fifteen contracts a day. All labor was paid the rate of $4.50 for eight hours, and the men are working under rigid inspection, with no apprentices or helpers, each man being a journeyman wireman. The head of the wiring department made an effort to keep the men on as near one class of work as possible, taking advantage of the fact that the same piece of work done many times in succession can be done very much better and very much more quickly at the end of a large number of operations.

The effect of this campaign on the degree of saturation in our various communities is interesting, as shown in the accompanying table.

Some of these towns were just connected during the year and showed remarkable saturation in a short time. Baxter is the best example. As a matter of experiment the people of this town were told that if they came on the line with 110 customers each customer would receive one month's light free, and if they came on the line with 120 customers we would give each customer one month's free light and also light the street lights a month free. It will be noticed from the table that Baxter at the end of four months had more than twenty-five customers per 100 people. Saturation in this town is 176 customers. Luther and Berlin are 100 per cent towns. Gilman has 100 per cent of its houses and business places connected or under contract, but on Jan. 1 they were not all on the line. The same is true of Colo.

INCREASE IN CONNECTED CUSTOMERS IN COMMUNITIES SERVED BY IOWA RAILWAY & LIGHT COMPANY

Town	Population		Customers		Increase	Customers per 100 Pop. (1915)
	1910	1915	January 1, 1916	January 1, 1917		
Luther	130	141	39	63	24	44.66
Sheldahl	202	226	46	61	15	27.00
Slater	473	670	148	168	20	25.22
Boone	10,347	12,253	1,947	2,238	291	18.34
Nevada	2,138	2,686	542	670	128	25.02
Colo	463	536	0	123	123	22.90
Marion	4,400	4,675	738	831	93	17.79
Montour	383	413	84	103	19	24.93
Le Grand	338	364	64	77	13	21.15
Gladbrook	869	959	161	247	86	25.73
Tama	2,279	2,621	554	625	71	23.46
Toledo	1,627	1,721	481	551	70	32.02
Chelsea	507	582	93	121	28	20.78
Blairstown	532	584	115	149	34	25.51
Berlin	143	143	0	37	37	25.87
Morrison	173	218	0	42	42	19.26
Marshalltown	13,374	16,065	3,110	3,598	488	22.44
Gilman	430	477	95	176	81	36.90
Belle Plaine	3,121	3,668	681	806	125	21.71
Perry	4,630	5,455	1,339	1,408	69	25.83
Dana	183	213	40	54	14	25.35
Grand Jct	1,012	984	173	209	36	21.24
Rippey	407	403	0	90	90	21.33
Woodward	712	820	193	240	47	29.26
Cedar Rapids	32,811	40,667	7,076	8,182	1,106	21.66
Oxford	614	577	25	112	87	19.41
Solon	450	441	0	76	76	22.11
Shellsburg	527	605	0	133	133	22.10
Coon Rapids	1,084	1,218	(285)	294	9	24.13
Baxter	527	572	0	145	145	25.35
Rhodes	500	451	0	76	76	16.90
Tiffin	176	196	0	29	29	13.06
Robins	50	125	0	19	19	15.20
Luzerne	160	161	0	23	23	14.25
Scandia	Power	Power	1	2	1	.....
Traer	1,373	1,378	.....	315	....	22.86
	87,156	103,268	18,030	22,093	3,748	21.39

Another interesting feature of the campaign is the method of soliciting employed. The further the writer goes into the question of the best method of securing new business the more he is convinced that the rotation soliciting is the best and gets a larger percentage of contracts with a fewer number of calls. We have one man, for instance, who is regarded as rather a slow worker, but he makes his call clean and concise and closes 80 per cent of his contracts on the first call.

This was the method employed throughout our campaign. Every salesman had but one thing to sell, and that was housewiring. The writer has found that more young solicitors fail on account of having too many things to sell than for any other one reason.

This personal selling in our campaign was supported strictly by publicity, including advertisements in the local newspapers and in Cedar Rapids, with an electrical page which created a great deal of most helpful interest.

*This does not include 399 customers on Iowa Electric nor 41 on wholesale towns.

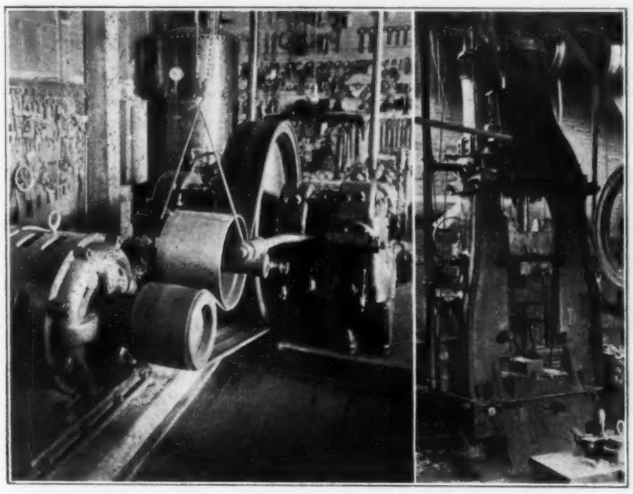
STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

REPLACING STEAM HAMMER WITH ELECTRIC DRIVE

How a Steam Hammer Was Converted Into an Electro-Pneumatic One and Satisfaction Obtained Therewith

The Cumberland County Power & Light Company of Portland, Me., has recently been successful in the conversion of steam-hammer equipment to electro-pneumatic service, a pioneer installation being made at the plant of the Marine Hardware & Equipment Company. At this place a 1200-lb. (544-kg.) Bement-Niles steam hammer was in service, steam at about 90 lb. per square inch (6.3 kg. per sq. cm.) being required over many hours daily. To avoid condensation troubles it was necessary to run the hammer practically all the time. As electric motor drive had been adopted for other purposes throughout the plant, it was found possible to do away with the demand for continuous high-pressure steam by adapting the steam hammer to air operation and installing a motor-driven compressor to supply air for this purpose and other requirements. The valve of the hammer was rebuilt for a fit of 0.0025 in. (0.064 mm.) compared with a previous fit of 0.005 in. (0.127 mm.) under steam service. The hardware company purchased a 50-hp., 220-volt, three-phase Westinghouse squirrel-cage induction motor designed for 900 r.p.m., and belted it to a 12-in. by 7-in. by 12-in. (30.5-cm. by 17.8-cm. by 30.5-cm.) Sullivan compressor delivering air at 90 lb. (6.3 kg. per sq. cm.). An idler pulley was employed as the maximum distance between the motor and compressor pulley was only 6 ft. 4 in. (1.92 m.). Connected with the compressor is a storage tank 8 ft. (2.4 m.) high and 48 in. (1.2 m.) in diameter, from which air is supplied to the hammer.



MOTOR-DRIVEN AIR COMPRESSOR OPERATING CONVERTED STEAM HAMMER ON RIGHT

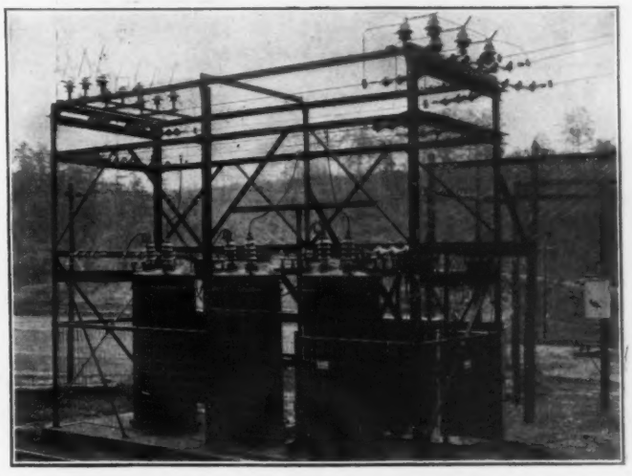
The hammer is supplied with air through a 2-in. (5.1-cm.) main and it exhausts through a 3-in. (7.6-cm.) pipe into a 1½-in. (3.8-cm.) reduction outlet at the roof of the factory. A branch exhaust terminating in two ½-in. (1.3-cm.) pipes is led down the frame of the hammer to outlets directed upon the working anvil surface, so that all chips and scale are immediately blown away in operation. Compressor cylinder oil is used in the air cylinders, a small mechanically driven oil pump being mounted on top of the hammer cylinder head for this service. It has been found that harder and quicker blows can be struck than under steam conditions. Control of the hammer is obtained by a foot valve and lever.

The success of this installation has led to the prospective early application of electro-pneumatic service to four hammers in another plant where one 1000-lb. (454-kg.), one 1200-lb. (544-kg.) and two 2000-lb. (907-kg.) hammers will be supplied with air furnished by a 150-hp. motor-driven compressor with a 12-in. by 48-in. (30.5-cm. by 1.2-m.) storage tank.

STANDARDIZATION IN OUTDOOR SUBSTATIONS

Southern Company Working with View Toward Simplification of Construction and Reduction of Cost per Station

About five years ago the Georgia Railway & Power Company began the installation of outdoor substations. It did not find in the market the kind of material desired, and for this reason it has manufactured its own horn-gap lightning arresters, switches, framing and similar apparatus.



STANDARD OUTDOOR SUBSTATION

The accompanying illustration shows a substation at Cartersville, Ga., which is typical of the substations being built by the company. This is a three-phase, 60-

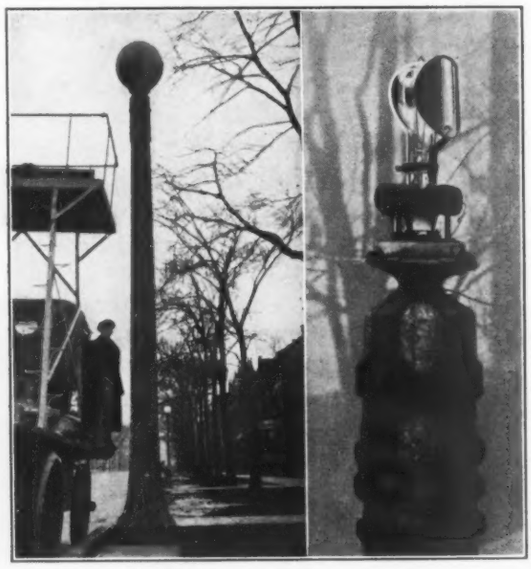
cycle station with three General Electric 38,000-2300-volt transformers. The insulator pins used are made of paraffined locust which is the company's standard, and they are screwed into the split castings instead of being cemented therein. Care is taken to anchor the lines directly to the framing so that the side strain on the pins does not exceed 600 lb. (272 kg.). The insulator cap and pin are removable, so that by making proper jumper connections insulators can be replaced without opening the circuit. Unlike standard apparatus, the transformer taps can be changed to raise and lower the voltage without shutting down the station.

The company estimates that during the year 1917 it will manufacture about $75,000 worth of high-tension apparatus. During 1916 it built substations of the kind described above at the rate of about one a week.

SHADING STREET LAMPS

Practicable and Inexpensive Substitute for Unsightly Black Paint Inside Globes

Some time ago when the residents along the boulevards on Chicago's North Side complained of the excessive light entering windows of their homes from the incandescent street lamps, one-half of each globe



FIGS. 1 AND 2—PAINTED GLOBE WHICH WAS OBJECTIONABLE IN APPEARANCE AND METAL SHIELD WHICH WAS SUBSTITUTED

was painted black on the inside to reduce the light causing the objection. In order to maintain the paint in satisfactory condition it was necessary to repaint each globe once every six months. Besides causing a continual expense, this method of cutting down the undesired light was considered very unsatisfactory because the blackened globe detracted from the appearance of the street-lighting system.

To overcome the difficulty, Claude H. Shepherd, electrical engineer for the Lincoln Park Commission, has fitted each offending standard with a device like that shown in Fig. 2. It consists of a curved metal shield attached to a brass clamp which fits the neck of the straight-sided type of lamp used. The jaws of the clamp in each instance have been covered with asbestos tape which was shellacked so that it would not be necessary to clamp the bare metal against the glass. These shields were made at a cost of 50 cents each. In the daytime they give no evidence of their existence. At night they do not produce nearly such objectionable black spots in the street-lighting fixtures as were caused when the paint was used.

Aluminium instead of black paint was tried, but it also made the globes look dirty and had to be renewed frequently. The method employing the shields is now considered more economical and more sightly.

PECULIAR TROUBLE WRECKS WHOLE TRANSFORMER BANK

Destruction of Three Transformers by Siphoning of Oil Indicates Need of Periodic Inspection and Preventive Measures

BY ALBERT MARTINEAU

It seems hardly possible that the combination of two things—a transformer lead that siphoned oil and a heavy load—should combine to interrupt an important load and do considerable and expensive damage. However, one transformer of a bank of three pole-type distributing transformers recently burned out, caught fire and resulted in the wreckage of the whole installation. What actually happened, so far as could be ascertained after the event, was as follows: The oil from one distributing transformer had been escaping along one of the secondary leads, the latter acting much like a siphon. As this had been in progress for some time, the oil level had been considerably lowered, likewise the heat-dissipating ability of the oil, since there was less of it, and the unit had been running hotter than the other two units making up the three-phase bank. As the load was maintained at about full rating for ten hours or so daily, the transformer with the low oil level became hotter and hotter until eventually the oil gave off vapor (the flash point is about 160 deg.), which caught fire owing perhaps to an internal or lightning arc.

In the usual case the transformer would merely have burned and been destroyed, service being interrupted, but the other two units would have been unaffected. In the present case, however, the oil in siphoning out of the transformer had trickled down to the platform upon which the three transformers rested. The fire from the transformer followed the oil-soaked rubber transformer lead and ran up to the woodwork above and down to the oil-soaked wooden platform below. As the latter burned through it failed under the burden of the three transformers, and these fell to earth, one being destroyed and the other two damaged as the result of the fall.

While this incident is rather unusual, it is only what might be expected to occur oftener when the vast number of distributing transformers in use is considered. Ordinarily, however, the destruction of only one transformer and perhaps one cross-arm would result.

The moral of the accident is that it is advisable to inspect all distributing transformers before installation, and at least once soon afterward, to make sure that the oil is not siphoning out and that the oil level is maintained at the proper height. Siphoning of oil may appear to be a very small matter, but it is capable of reducing the capacity of a transformer and interfering

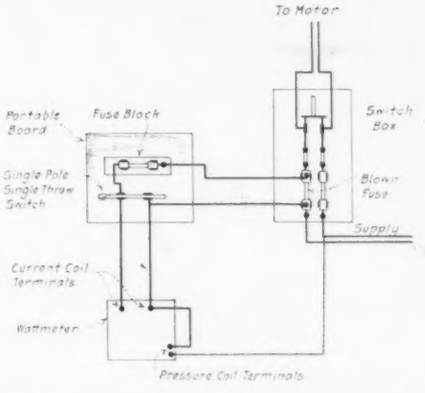
with voltage regulation, consequently with the maintenance of balanced phase relations, and resulting in the damage, if not eventual failure, of the transformer itself as well as service interruptions. Moreover, a transformer with low oil level is more susceptible to damage from lightning.

Probably the most satisfactory manner of preventing oil from siphoning up the leads of distributing transformers, where the distances are small and clearances close, is to cut back the insulation for 1.5 in. to 2 in. (3.81 cm. to 5.08 cm.) and solder the strands of the conductor. This overcomes the capillary attraction between the strands and thus prevents the leakage of oil. It should be done above the oil level, of course.

THE WAY TO AVOID DELAYS IN TESTING

Reliable and Convenient Method of Connecting Test Apparatus in Line Without Long Interruption of Service

Sometimes it is desired to take power or energy-consumption readings without interrupting the operation of the apparatus on the circuit. The accompanying diagram shows a method by which a wattmeter or watt-hour meter may be connected into the circuit in the short time required to stop the motor and start it again. As shown in this diagram, leads are soldered to the ends of a blown fuse. The terminals of these leads are connected through a fuse block and a single-pole switch, which are mounted in series on a portable board. Shunted across the switch are the leads from the current coil of the wattmeter. When the portable meter is to be used the switch in the power circuit is opened, one of the fuses therein replaced by the blown fuse mentioned, the power-circuit switch closed, and the motor started again. One of the terminals of the pressure coil of the meter is connected to the current-coil terminal and the other terminal is connected to the opposite side of the line. By opening the single-pole switch on the test board the wattmeter is connected



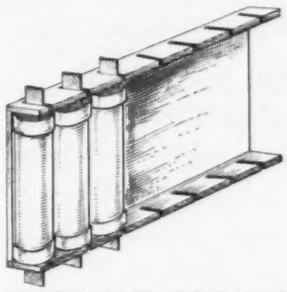
METHOD OF CONNECTING PORTABLE TEST SET

in series with the line. The value of this switch is apparent, as it may be closed and the meter removed and replaced by one of different rating, if so desired. To insure providing the same protection for the power circuit that is afforded when the test set is not being used, the fuse removed from the power circuit may be inserted in the clips provided on the test board.

LOW-COST FUSE RACK

Designed to Hold Seven Cartridge Fuses so That They Can Be Removed Quickly

A rack from which fuses can be taken quickly and which costs little or nothing to construct is in use at the Indian Orchard station of the United Electric Light Company of Springfield, Mass. As shown, it consists of a pair of ¾-in. (1.9-cm.) strips of wood with slots 2 in. (5.1 cm.) apart and attached to a 13-in. by 8½-in. (32.9-cm. by 21.6-cm.) base, which is screwed to the wall at two points. The slotted pieces are 1¾-in. (4.4-cm.) deep and accommodate seven 150-amp. inclosed-type fuses. No time is lost in hunting for fuses with this simple but effective arrangement.



SLOTTED LEDGES THAT SERVE TO HOLD FUSES

COST DATA ON INSTALLATION FOR LIGHTING CITY STREETS

Low-Voltage Series System Operated with Pole-Type Constant-Current Regulators at Lincoln, Neb., Proves Economical

The cost data given here apply to a series tungsten-lamp circuit equipped with a pole-type constant-current regulator and recently installed in Lincoln, Neb. The lighting system consists of fifty-two 100-watt type C lamps spaced 150 ft. (45.7 m.) on the boulevards that have a parking space in the center. On the other streets the posts are staggered. The primary side of the regulator is equipped with an oil-immersed time switch. The only attention required for this installation is to wind the clock of the time switch once in every eight days. An adjuster coil is used in conjunction with the regulator but is mounted separately on the pole. The total cost of the installation, including iron posts, steel-taped armored cable, etc., was as follows:

4,550 ft. No. 8 two-conductor steel triple-armored cable	$939.36
3,600 ft. No. 8 single-conductor triple-armored cable	373.44
52 iron posts with outer globes and series sockets	1,033.85
52 100-cp mogul-base series type C lamps	52.00
52 concrete bases for poles	103.00
150 iron anchors for concrete	6.50
15 lb. rubber tape, 10 lb. friction tape and 3 pails insulating compound	20.00
5-kw. pole-type regulator	159.60
Primary time switch	75.00
Plow, tool box, 12 wooden forms for concrete base, lumber for pole platform, 40 ft. 1½-in. galvanized pipe put in ahead of paving, and 100 ft. of 1-in. conduit for side of regulator pole	175.95
Paint and painting poles	47.50
Labor, digging and electrical work	417.24
Total	$3,403.44
10 per cent for superintendency and administration expense	340.34
Total	$3,743.78

The average cost per pole is $72. The maintenance on this system is very low and the amount of power demanded with fifty-two lamps burning is just a trifle over 4 kw. This installation was carried out under the supervision of Paul W. Doerr, assistant superintendent water and light department, Lincoln, Neb.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

LISTING CONNECTED MOTORS ON POWER CONTRACT CARD

Brockton Company Thus Maintains Up-to-Date Record of Power Service Which Is Very Convenient for Billing

By listing the electric motors connected in each installation upon a power contract card, as illustrated, the Edison Electric Illuminating Company of Brockton,

CONNECTED LOAD.

DATE	¼ H.P.	½ H.P.	¾ H.P.	1 H.P.	2 H.P.	3 H.P.	5 H.P.	7½ H.P.	10 H.P.	15 H.P.	20 H.P.	25 H.P.	35 H.P.	50 H.P.	75 H.P.	100 H.P.
4/17/16		4	3	10	3		1		1							
12/20/16		6	3	15	3		2		1							
6/1/17		10	3	15	3		2		1							

CONTRACT CARD, SHOWING MOTOR LISTINGS

Mass., maintains at all times an up-to-date record of its power service. In figuring the monthly service charge these data are highly convenient and occupy but little space.

MOVING A CENTRAL STATION OFFICE TO MAIN STREET

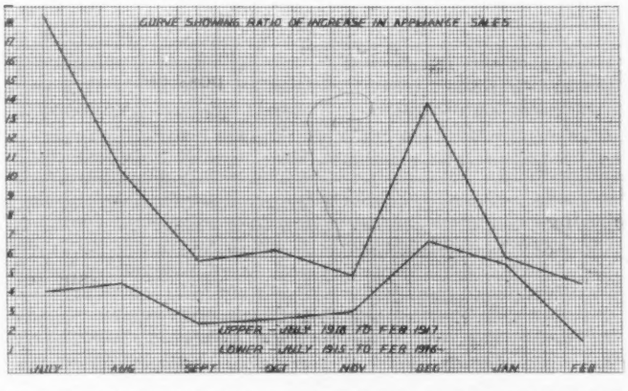
A Change of Location to the Business Center Proves Entirely Profitable at Indianapolis—Business Increases Shown Graphically

On July 10, 1916, the Merchants' Heat & Light Company of Indianapolis, Ind., opened a new salesroom on the most prominent corner in the city. Every opportunity was accepted to acquaint the public with the change from the company's old unfavorable location to the new "daylight corner," as it was called. The move was one to give the company's patrons more convenient office and store service and to get in return more business. The location was selected as the best in the city, since it is on a corner past which most pedestrians, most vehicles and most street cars must go in the ordinary course of traffic. Since the change took place records have been kept to determine whether or not the move, with its attendant increased expense, has paid as a purely business proposition. From these records, according to R. A. MacGregor, the company's sales manager, the decision is that the move was entirely profitable. Figures on comparative growth, which may be read from the accompanying curve, show to what degree the business of the company increased after the change over the same months of the preceding year.

The appliance sales for the month of July, for instance, showed a gain in the ratio of 4.2 to 18.6, or more than 340 per cent. It will be observed that this same ratio of increase was not maintained continuously. The falling off in August and September may be attributed partly to the fact that the July sales were forced by newspaper publicity given the new store. But the fact that the average gain in appliance sales for the period covered was approximately 140 per cent is one which should not be overlooked. It is a true indication of the general popularity of the more favorable location. It should also be pointed out in connection with these curves that appliance sales have not been pushed with all the vim that might have been exercised on account of the competitive central station situation which exists. It is considered, therefore, all the more remarkable that the continued growth in appliance sales should be sustained, even after the novelty has worn off the new store.

When the company was established on a side street in the wholesale district it was not in a position to impress itself upon the general public. Now, in its new location, the very fact that over three times as many people in July, over three times as many in August, over twice as many in September, and almost one-third more in October, practically the same number in November, over three times as many in December, nearly three times as many in January, and one and one-half times as many in February, voluntarily came into the office and sought its service certainly can be attributed to the removal.

In addition to the absolute traceable dollars and cents



CURVES SHOWING RATIO OF INCREASES IN APPLIANCE SALES AT "DAYLIGHT CORNER"

increases in various departments of the business, the new location is felt to have other value. Its convenience for patrons is seen as a part of the service the company owes the public. It presents an opportunity for the company to form points of contact with greater numbers of people and to emphasize its desire to provide uniformly courteous service.

COMFORT AND CONVENIENCE OF PUBLIC UTILITY SERVICE

Customers' Subconscious Realization May Be Awakened to the Relation that It Bears to Progress and Life

A letter was recently received by the ELECTRICAL WORLD in which the following suggestion was contained:

"In view of the service furnished the public by water, gas, electric and street railway companies, it has occurred to me that these companies could be more properly referred to as 'public comfort companies' rather than as corporations, public utility or public service companies. The public seldom realizes the comfort and conveniences furnished by these companies until a calamity of some nature interrupts the service temporarily."

The idea in the last sentence is particularly significant in that it affords utilities an opportunity to impress upon customers and the public generally the fact that, although service may temporarily be interrupted owing to one condition or another, as a matter of fact the amount of time during which service is interrupted is considerably less than 1 per cent. Furthermore, electric service can be put almost in the same category as food, because a slight interruption in a service causes considerable annoyance, inconvenience and displeasure. It is very doubtful if the customers realize to what an extent they depend upon electric service. The mere fact that they become displeased with an interruption of service indicates quite clearly that customers look upon electric service as indispensable, although this feeling may be subconscious. It is not impossible to awaken this subconsciousness to a realization of the service rendered by utilities and what an important relation it bears to progress and every-day life.

ELEMENTS INVOLVED IN RATE INVESTIGATION

Report of Committee of Canadian Electrical Association Analyzes Factors by Means of Comprehensive Chart

Printed herewith is a chart which is intended to show in a readily appreciated form the possible elaboration of a rate research study. This chart was developed by the rate research committee of the Canadian Electrical Association, which deems it advisable to indicate all factors required to enable any one interested in rate making to proceed with an investigation.

In view of the variety of subjects deserving investigation the committee felt that it could only suggest the most pressing topics for investigation and comment briefly on the problems thus chosen. Taking the main branches in order, the following were found to be the most important:

Legal Contracts and Consequential Damages.—A standard form of non-liability clause should be included in all contracts, and the following is a form which is used by one of the larger companies: "The company does not guarantee a constant supply of electricity and shall not be liable for any damages to the consumer in consequence of its failure to supply electricity at any time or times."

Standardization of Rate Forms.—It would be a good thing if rate forms for similar classes of service could be of the same type in various parts of the country. All of us are familiar with the difficulties experienced in dealing with a new customer from another part of the country who is accustomed to a rate form which is not included in the rates available. A difference in price is not difficult to explain, as the prices of many things vary with location, wages, etc., but a totally different form of rate, not easily understood by customers, is more difficult to explain, and creates a feeling of distrust which no explanation will eradicate.

DURATION OF PEAK LOADS

Demands.—There is at the present time an absolute lack of uniformity in the definition of what constitutes a "horsepower"; in some cases a twenty-minute average load is taken, in others a five-minute average load; in some cases three demands per month, in others a single demand.

The width of demand taken, especially in flat-rate contracts, is a determining factor in the revenue obtained from any service, and while in some cases the demand taken over a short period does not differ much from a demand taken over a fairly long period, in other cases the demand is a constantly fluctuating one, reaching maxima of short duration with regular frequency which if taken over a long period would not represent the capacity which has to be furnished to supply such demands.

Again in other cases the extreme maxima may be reached infrequently and be of short duration when demanded. Generally speaking, the central station company has the right to regard the question from two points of view—first, the reserve capacity for overloads existing in the plants supplying the demand; second, the amount of plant which would have to be installed by the customer to take care of the demand if the load were carried by an independent plant.

TO COLLECT DATA ON PEAK-LOAD CHARACTERISTICS

The committee proposes to collect data on the question of the characteristics of the demands taken by different industries which central stations supply, anticipating that such information may be of use to the members in providing data upon which rates can be based.

It has been suggested that steady loads are best rated upon long-demand intervals and fluctuating loads upon short intervals, but while on the face of it this may appear fair it is open to the objection that the steady load with no diversity is rewarded and the fluctuating load with high diversity is penalized.

Undoubtedly where water storage is possible or where the system is large compared to the demand to be rated this solution is open to criticism.

Another solution is to abandon flat rates altogether and substitute mixed rates with a flat-rate portion of the charge producing only 30 to 50 per cent of the total revenue. Under these conditions the matter of peak period can be more easily standardized, as a short peak period will not unduly penalize any customer, and a low-load factor, i.e., of high diversity, will be taken care of equitably by the meter rate portion of the charge.

Measurements for Revenue.—Instruments for the determination of demand have been slow of development. The instruments required can be divided into

two groups—those required for small loads, say up to 50 hp., and those required for larger loads.

The requirements for small loads are low first cost and low operating costs; for large loads companies are warranted in obtaining high-class instruments and employing specially trained help for watching and calibrating the instruments used.

While there are now obtainable a few instruments for small loads filling the above requirements, they are all of a type which register energy only and leave a record of only one demand without indicating the time at which the demand occurred. There is without doubt a great need of an instrument for the small load, and the lack of one has forced most companies to the expedient of depending on haphazard tests or of taking the rating or some fraction of the rating of the apparatus connected as the basis of charge for the flat-rate portion of the account.

For the large customers many excellent graphic meters are obtainable. These, however, are open to the objection that a fluctuating load cannot be accurately integrated, and also the record is very bulky and the instruments require continual attention.

Temporary Loads and Cost of Service.—The tremendous demands created by the war on the central station have produced a problem in rate making which requires careful consideration. While the central station has a patriotic duty to perform in trying to accommodate all loads offered, nevertheless where such demands require the installation of generating plant and lines which are liable to be idle when the demands are lessened and when such extensions can only be purchased at supernormal prices and will be depreciated from 50 to 70 per cent when prices become normal again, it is obviously the part of the customer to pay either in the rate or as a separate item at least the depreciation plus the interest on such capital as will have to be carried idle for the period after the demand is withdrawn until normal business again requires extensions. If this is not done, companies are liable to be faced with lower earnings and higher fixed charges after the war. Broadly speaking the rate should cover the investment required in all cases plus a fair profit, and if this cannot be obtained the business will be well refused.

Psychology.—The modern trend of thought is all toward the scientific study of cause and effect, and some problems of rate research can hardly be classified under another head.

Good Will.—Technicians and experts too often make rates which are far beyond the comprehension of customers, and while such forms are possible of application between expert and expert they savor too much of the methods attributed to autocracy to be advisable in dealings between public service corporations and their customers.

Expediency.—This again is a question which will bear discussion and one which should not be hidden under a bushel.

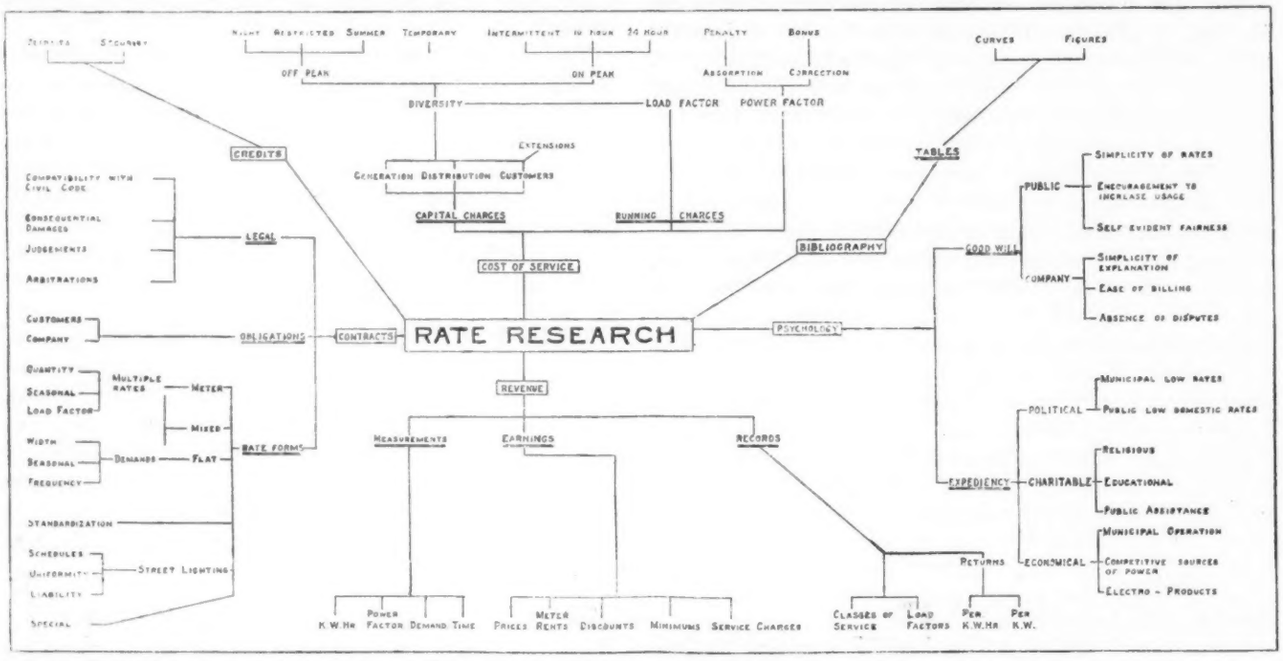


CHART DEVELOPED TO BRING OUT THE POSSIBLE ELABORATION OF A RATE RESEARCH STUDY, INDICATING THE FACTORS OF AN INVESTIGATION

Again, where the cost of energy is the critical factor in the success of the enterprise—i.e., electric product manufacture—a low rate is justifiable, but where the cost of energy is an incidental cost in a highly profitable industry the central station has a right to a good profit.

Charity.—With reference to low rates for hospitals, schools, etc., it is an understood thing that no one wishes to make an ordinary profit out of such institutions, inasmuch as they represent the manifest desires of the community to promote its well-being, so therefore there should be no disposition on the part of the stockholder *per se* to take a profit indirectly through his holdings in a central station company.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

DIELECTRIC LOSSES IN INSULATING MATERIALS

Materials Treated with Varnish or Compounds Requiring Drying or Curing Show Higher Losses Than When Saturated with Fluid Insulators

DURING the last five years the research division of the Westinghouse Electric & Manufacturing Company has been carrying on almost continuous investigations of the losses in dielectrics. A considerable variety of insulating material has been studied in a preliminary way, and measurements have also been made on completed apparatus such as transformers, generators, condenser bushings, etc. In a paper presented before the joint meeting of the Electrical Section of the Franklin Institute and the Philadelphia Section of the American Institute of Electrical Engineers, C. E. Skinner, engineer of the Westinghouse research division, called attention to some of the apparatus used in these studies and the results thereof.

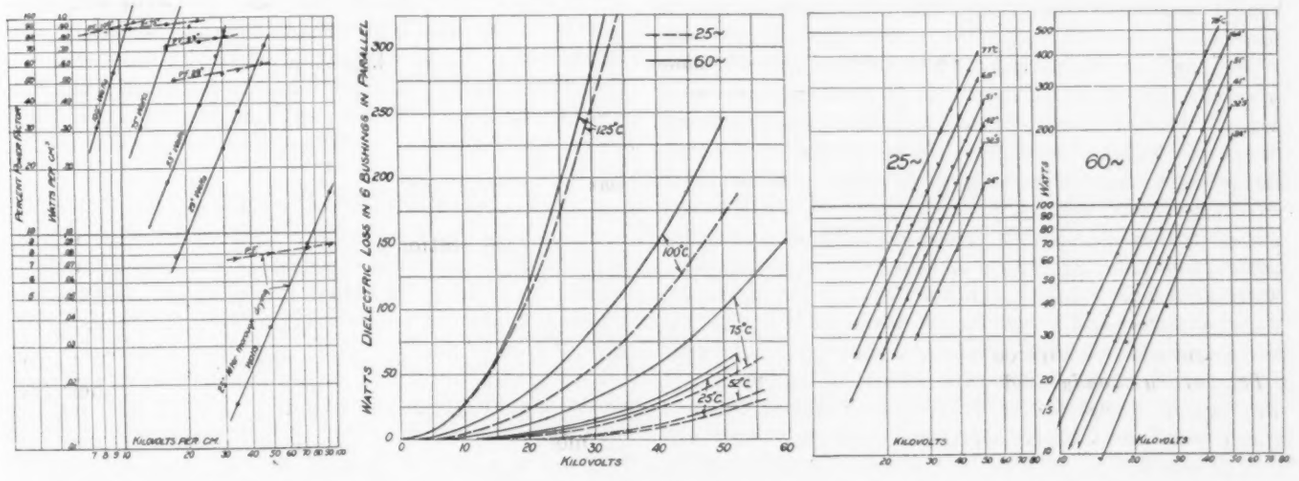
The quadrant electrometer wattmeter was adopted as the most convenient and satisfactory instrument for this study. The voltmeter which was used was of electrostatic type, designed by Prof. H. B. Smith of Worcester Polytechnic Institute. An ammeter adapted from the Kelvin multicellular static voltmeter was used.

The accompanying curves give a number of interesting examples of the results obtained by this investigation, but they should not be taken as representative of the various classes of materials, owing to the fact that in practically all cases investigated different samples of the same material often showed as much variation as different kinds of materials. The results were influenced considerably by various kinds of treatment. In general it may be said that the lower the losses and power factor and the higher the insulation resistance the better the quality of the insulation. As a rule, low specific inductive capacity is desirable, but not for all uses.

In tests of fuller-board to show the relation between power factor and kilovolts per centimeter thickness, and also the relation between watts per cubic centimeter and kilovolts per centimeter thickness at two temperatures, it was noted that there was a very wide difference in values of the two samples, particularly at a temperature of 100 deg. C. The only difference between the two samples was that the first was exposed to ordinary atmospheric influences for a period of ten days after being vacuum-dried and oil-saturated. Although it was oil-soaked, this sheet had undoubtedly absorbed a small amount of moisture which affected its insulation resistance at high temperatures as well as its other characteristics.

A sample of micarta sheet which was only partially processed showed excessive losses. The same sheet was again tested after thoroughly drying, and very decided improvement was shown. The uncured condition of the power factor of this material reached almost 100 per cent at the higher temperatures to which it was subjected (100 deg. C.). This factor can be greatly reduced by proper processing. With these data plotted to logarithmic scale, the slope of the watt-voltage curve increased with temperature. The critical point can be readily determined in this way. Attention should be called to the fact that at ordinary temperatures the dielectric loss is a far better indication of the quality of the material than the insulation resistance.

On account of the very low dielectric losses and power factors of condenser-type bushing at normal operating voltages, tests were made by measuring six bushings in parallel to secure more measurable quantities. Since the normal operating voltage stress to ground on these bushings when applied to apparatus on a 44,000-volt transmission line is approximately 25,000 and the maxi-



FIGS. 1, 2 AND 3—CHARACTERISTICS OF MICARTA SHEET, CONDENSER-TYPE BUSHINGS, AND INSULATION OF A CORE-TYPE TRANSFORMER

mum temperature which they will likely reach in service will not be over 75 deg. C., owing to conduction of heat from other parts of apparatus, it was concluded from the tests made that the loss per bushing, even at 60 cycles, will not be over 3 watts or 4 watts in normal operation. At temperatures below 75 deg. C. the loss varies practically as the frequency. It is also noted that the increase in loss is very rapid at 100 deg. C. or higher.

The charging current for the same bushings at 25 and 60 cycles followed practically parallel curved lines, their curvature increasing more rapidly with the higher temperatures (100 deg. C. to 130 deg. C.). The insulation resistance of the bushings at 10,000 volts direct current was found to decrease in proportion to the increase in temperature, the resistance being about 100,000 times as great at 25 deg. C. as at 125 deg. C. This change of insulation resistance is so great that the losses due to actual conduction are much greater than those due to the so-called hysteresis or dielectric losses. This explains the reason why the losses at both 60 and 25 cycles are so nearly the same at 125 deg. C.

From measurements of the condenser bushings to show the relation of dielectric loss to temperature and the relation of power factor to temperature, it was found that the critical losses begin to manifest themselves at temperatures between 80 deg. C. and 90 deg. C. When the relation between dielectric loss and kilovolts applied to the same bushings was plotted on logarithmic scale, it was noted that the loss at 25 cycles is increased approximately fifteen times by raising the temperature from 25 deg. C. to 100 deg. C. At 60 cycles the corresponding change is approximately six times.

With two micarta sheets of somewhat different character, it is noted that the insulation resistance decreases with the increased voltage used in its measurement in one case, and in the other the insulation resistance remains practically constant as the measuring voltage is increased. In both cases the power factors are relatively high, this being the condition found at the higher temperatures at which both sets of measurements were made. Furthermore, it was observed that the power factor as well as the insulation resistance of the condenser-type bushing remains practically constant with varying voltage, while with the micarta sheet the power factor increases with increased voltage in about the same proportion as the insulation resistance decreases with increased voltage. This relation between insulation resistance and power factor, which it is believed is here shown for the first time, appears to hold only for power factors of more than 15 or 20 per cent. It was found possible to carry the treatment of micarta sheet to a point where the insulation resistance and the power factor will remain constant with varying voltage.

Tests were made of the insulation of a synchronous condenser stator rated at 400 kva., 6000 volts and 50 cycles, in which it was found that the loss was about 0.007 watt per cubic watt per cubic centimeter for 6000 volts at 15 deg. C. and about 0.0315 watt per cubic centimeter at 71 deg. C., 60 cycles. The average under actual operating conditions would not be over one-third of these amounts.

Extremely interesting measurements were made in connection with a number of transformers. In all cases the measurements were made from the high-tension winding to the low-tension winding and the core connected together. A considerably higher rate of increase of watts per kilovolt was observed at the higher frequency (60 cycles) than at the lower one (25). The power factor was observed to increase with the voltage much faster at high temperatures than at low temperatures. On the other hand, the watt loss increase with voltage is more rapid at low temperatures than at high temperatures.

Generators, Motors and Transformers

Theory of Armature Windings.—S. P. SMITH.—In this paper the author discusses the arrangement of single-layer windings, the determination of the number of slots to use, the whole and fractional number of slots to employ per pole, and the use of empty slots and unequal coil groups. Double-layer windings are also taken up, their arrangement, phase tappings off closed windings, polygon tappings and open double-layer windings being discussed.—*Part of Abstract from Proceedings of London Inst. of Elec. Engrs., London Electrician,* May 25, 1917.

Generation, Transmission and Distribution

Notes on Construction of Turbine Pumps.—ALAN E. L. CHORLTON.—(Portion of paper read before the London Institution of Mechanical Engineers.) The paper traces the development of some of the methods of successfully overcoming the difficulties experienced with turbines, and calls attention to points in design which are the result of the author's experience extending back to the infancy of the application of the turbine-pump principle. These subjects are taken up under the following headings: (1) the stator, which consists of the casing or housing and the guide vanes or appliance for converting velocity energy into pressure energy; (2) the impeller (considered separately); (3) the balancing appliance—hydraulic or mechanical; (4) the rotor, considered as a whole, and including the spindle, with its projecting sleeves, impellers, and in most cases the balancing appliance; (5) the bed, and other details, bearings, stuffing-boxes.—*London Engineering,* May 25, 1917.

Wires, Wiring and Conduits

Effect of Stretching on the Thermal Conductivity of Wires.—A. JOHNSTONE.—Description of experiments in which the wire to be tested was fixed at each end between the jaws of screw clamps joined to brass cylinders, through which water could be circulated. Attached to one clamp was a rod passing through a framework, enabling tension to be applied by a nut working on a thread. Heat was supplied to the center of the wire by passing a current of electricity through a manganin coil wound on the wire, and the temperature difference between two points on the same side of the center was ascertained by two platinum coils, also wound on the wire. The resistances of the coils were determined by means of a Callendar-Griffiths bridge, enabling a temperature difference of 0.01 deg. C. to be read, and making it possible to detect a difference in conductivity of 0.05 per cent. If R_1 is the resistance of the platinum thermometer nearer the heating coil, and r_1 is that of the other platinum coil when both are at the jacket temperature, and if R_2 and r_2 are corresponding values when a temperature difference exists, then it may be shown

that the conductivity K is proportional to $(R_2 \div R_1) - (r_2 \div r_1)^{-1}$. For all the wires used (copper, steel, nickel, aluminium, brass, zinc), stretching produced a slight increase in thermal conductivity. The most satisfactory experiments showed an increase of about 0.5 per cent for a tension of about 0.7 of the elastic limit. After the tension was withdrawn the conductivity returned approximately to its original value.—*Abstract of paper presented before Imperial College of Science, London Electrician*, May 25, 1917.

Telegraphy, Telephony and Signals

Range of Wireless Stations.—CAPT. R. CHENEVIX TRENCH.—Modifications of Austin-Cohen empirical formula for range of radio stations so as to take into account the effect of actual working conditions. The results obtained are incorporated in a number of curves, and these curves are utilized in working out certain empirical examples. The curves shown apply to a sending set of 25 per cent efficiency between the alternator output and the power developed in the aerial. Where this efficiency in any particular case is known, or known approximately, the value of $h_1 h_2 \sqrt{P}$ should be

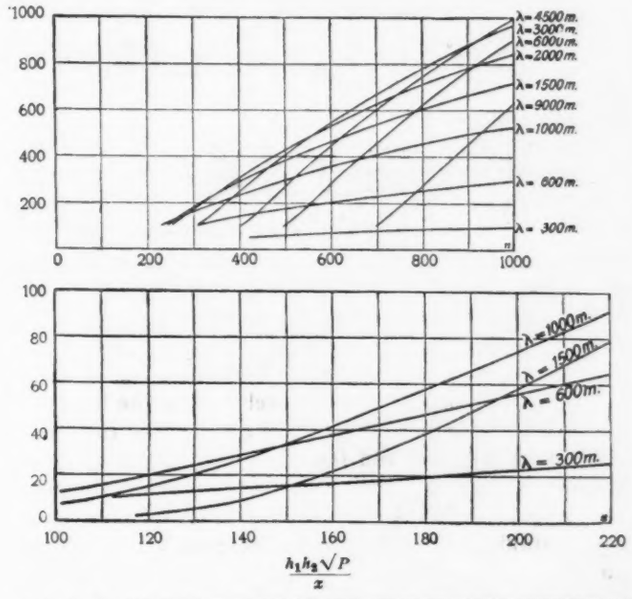


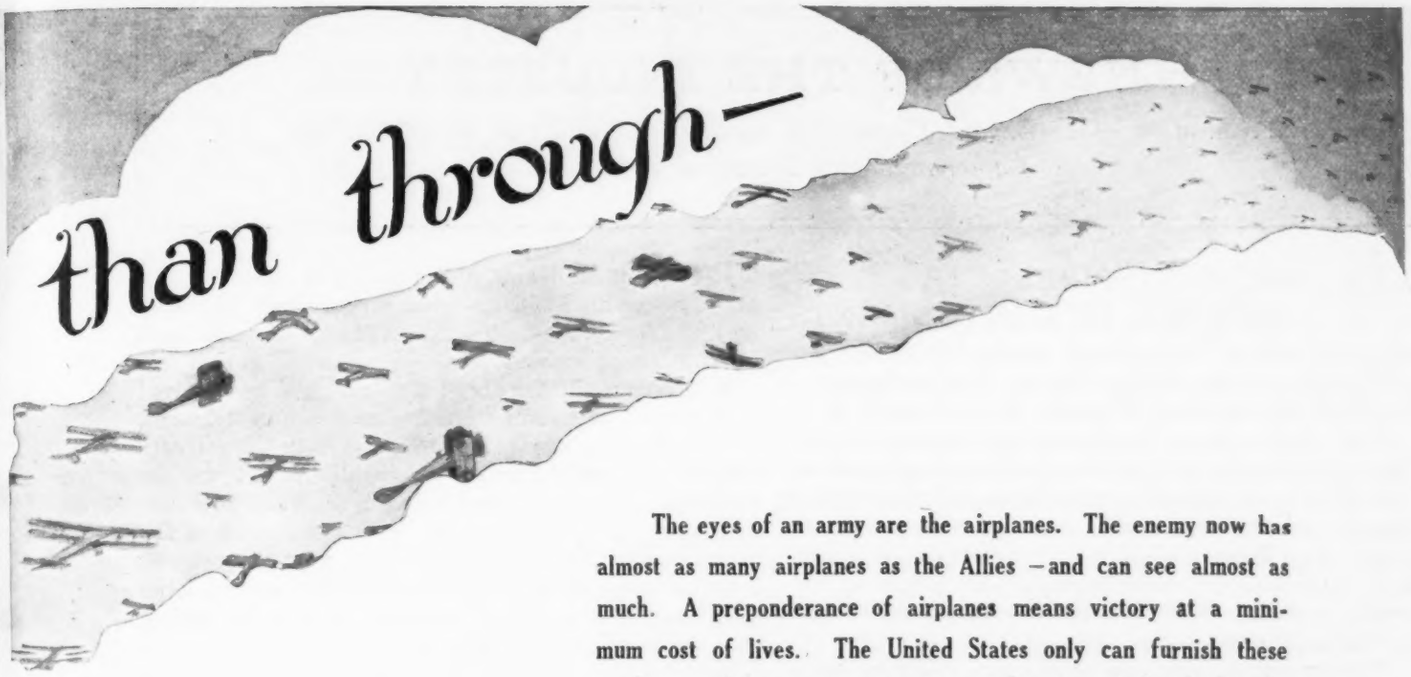
FIG. 4—RADIO RANGE WITH 25 PER CENT SENDING EFFICIENCY

multipled by $\sqrt{25/E}$, where E is the known efficiency. The large factor of sixty-four times audibility power which is taken should cover such variations (since sixteen times audibility is considered to give good communication), and so long as there is nothing seriously wrong with the receiving set the curves may be applied without modification for all ordinary purposes. Although there is no doubt that short waves travel better by night, there is some difference of opinion as to the night effect on long waves. It is probable, however, that all wave lengths travel better by night, and for general purposes this may be allowed for by replacing the absorption coefficient 0.0015 by a smaller coefficient 0.001, or by multiplying the daylight value of $h_1 h_2 \sqrt{P}$ by the factor $\varepsilon^{-0.0005x/\sqrt{\lambda}}$. In conditions under which little or no atmospheric interference may be expected, such as is the case with small-capacity low aerials, or in districts notedly immune from atmospherics, a smaller power than sixty-four times audibility may safely be taken, but the minimum power received should not be less than sixteen times audibility. That is, in such favorable cases, the value of $h_1 h_2 \sqrt{P}$ given may be modified by $\sqrt{0.25}$ or 0.5. When only a few short messages must be transmitted daily the received power may be reduced to about sixteen times audibility.—London *Electrician*, May 4, 1917.

Miscellaneous

Engineering Specifications.—J. SHEPHERD.—Some interesting methods of specifying the quality of supplies and engineering equipment and methods of contracting for certain kinds of engineering work were brought out in this paper. Among the subjects discussed were specifications for coal. Roughly the specification for minimum quality to be accepted which has been found satisfactory in purchasing 1,000,000 tons of coal is as follows: Calorific value must not be less than 11,000 B.t.u.; moisture must not exceed 14 per cent for washed nut coal or 9 per cent for unwashed nut coal; small coal must not exceed 30 per cent; ash must not exceed 15 per cent. Methods of sampling are given in detail, but in later specifications the final sampling was done by a motor-driven crusher and sampler. Methods of testing are then specified, namely, (a) for small coal, through a sieve with a mesh ⅜ in. square; (b) calorific value by Mahler bomb calorimeter; (c) moisture after drying at a temperature of from 104 deg. to 111 deg. C., and (d) ash determined by ignition at a low red heat. The specification provides for the adjustment of the price paid for any particular cargo, the adjustment being made as thus set out: "Should the quality of the coal in any cargo, as ascertained by samples tested, be found different, as regards calorific value, moisture, small or ash from the values offered in the schedule, the prices or sums payable shall be varied in the manner following, viz.: (a) If the calorific value be greater than the number of B.t.u. per pound offered in the schedule, the price per ton shall be increased in the same percentage ratio as the increase in the calorific value. (b) If the calorific value be less . . . the price per ton shall be decreased in the same percentage ratio as the decrease in the calorific value. The right to reject the whole cargo if the calorific value be less than 11,000 B.t.u. per pound is always reserved. (c) If the moisture be less by weight than the figure offered in the schedule, the weight of the coal to be paid for shall be increased beyond the quantity actually weighed out by a percentage equal to the percentage decrease of moisture. (d) If the moisture exceeds the figure, the weight of the coal to be paid for shall be decreased below the quantity actually weighed out by a percentage equal to the percentage increase of moisture. The right to reject the whole cargo if the moisture exceed 14 per cent by weight for washed nut or 9 per cent by weight for unwashed nut is reserved. (g) If the percentage of ash when determined in the manner set out in this specification be less than the figure offered in the schedule, the net rate per ton of coal shall be increased by 1 penny (2 cents) for every 1 per cent reduction in ash. (h) If the percentage of ash be more, the net rate per ton of coal shall be reduced by 1 penny (2 cents) for every 1 per cent increase in ash. The right to reject the whole cargo if the proportion of ash exceeds 15 per cent is reserved.—*Journal of Inst. of Elec. Engrs.* (London), May, 1917.

As the Eagle flies—
It is easier to go over

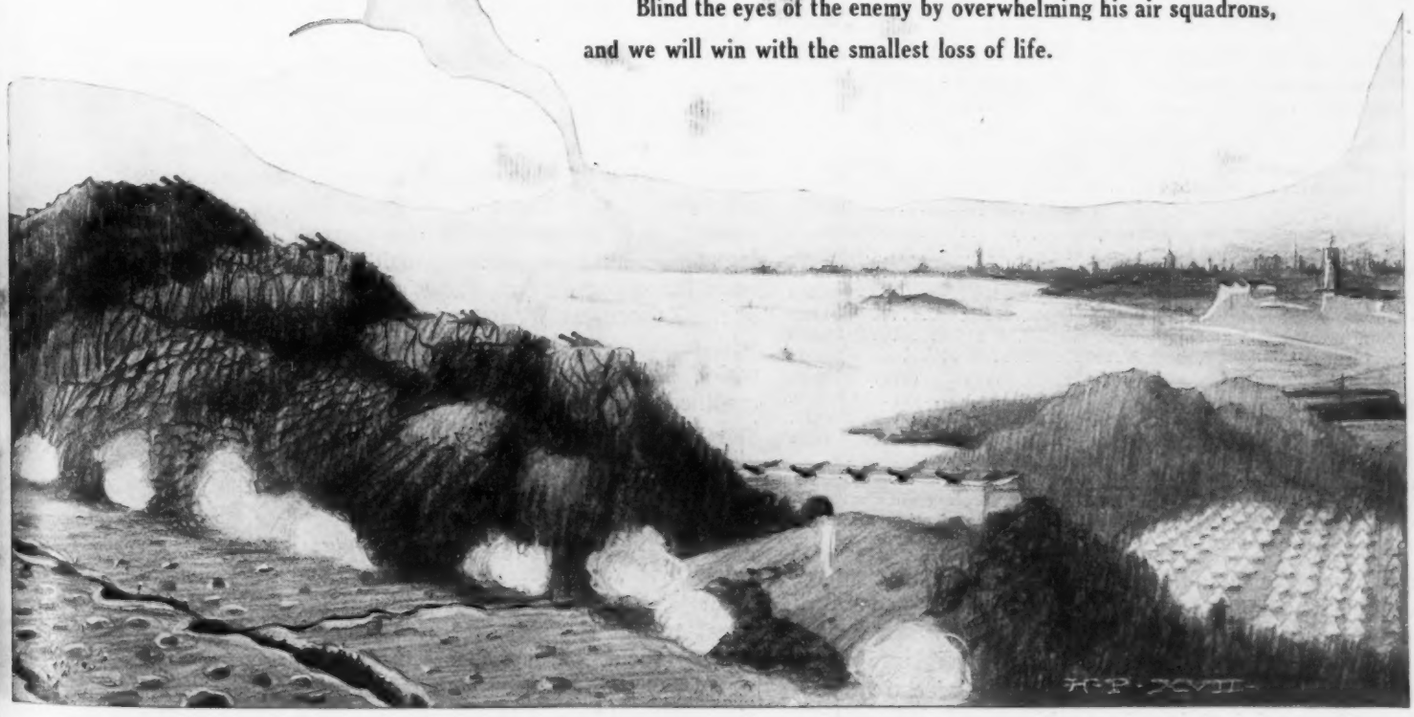


than through—

The eyes of an army are the airplanes. The enemy now has almost as many airplanes as the Allies—and can see almost as much. A preponderance of airplanes means victory at a minimum cost of lives. The United States only can furnish these machines and the necessary operators and equipment, for she has the material, shops and explosives. We need 50,000 machines and 10,000 aviators quickly—every day's delay means sacrificing the lives of thousands of our soldiers.

Fortifications of concrete, trenches, wire entanglements and all such obstacles mean a frightful loss of life to overcome by going through them, but by going over them in such numbers as to put the enemy airplanes completely out of action, explosives may be dropped on enemy batteries, transport lines, submarine bases, manufacturing plants, munition depots, battleships or troops at will.

Blind the eyes of the enemy by overwhelming his air squadrons, and we will win with the smallest loss of life.



NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

ELECTRICAL SUPPLIES NEEDED BY CANTONMENTS

Quartermaster's Department Issues Schedules for Material for the Entire Sixteen Cantonments—Large Quantities of Wire and Sockets Specified

The quartermaster's department has finished its estimate of the amount of building materials required in each of the cantonments for the National Army. The quantities may be more or less varied by construction needs which develop while the work is in progress, and the difference in climate between the northern and southern parts of the country has its effect on the quantities of some of the materials.

The amount of electrical equipment will vary with the shape of the cantonments. The estimate for the total requirements for the sixteen military cities amounts to 20,800,000 ft. (6,339,853 m.) of insulated wire, 260,000 ft. (79,248 m.) of lamp cord, 125,000 key sockets

SCHEDULE OF ELECTRICAL MATERIALS FOR SIXTEEN CANTONMENTS

Item	*Make	Quantity
Cleat receptacles	G. E. 031	150,000
Cleat rosettes	G. E. 430	125,000
Brass-shell key sockets	G. E. 012	125,000
Shades	Ivanhoe-Regent C.A.E. 40	120,500
Shades	Ivanhoe-Regent B.A.E. 40	125,000
Wire lamp guards	Morse No. 8 A	29,500
Single-pole snap switches, with porcelain sub-bases	G. E. No. 60450	22,600
Combined switch and plug cut-outs	G. E. No. 42688	27,800
Two-pole single-branch plug cut-outs	G. E. No. 61935	5,000
Single-pole main-line plug cut-outs	G. E. No. 62569	5,000
Edison plug fuses, 6-amp	G. E. No. 66329	15,000
Edison plug fuses, 10-amp	G. E. No. 66331	60,000
Lamp cord	No. 18 N.E.C. standard type P	261,000 ft.
Rubber-covered wire, No. 14	N.E.C. std. single-braid	20,000,000 ft.
Rubber-covered wire, No. 10	N.E.C. std. single-braid	816,000 ft.
Two-wire unglazed porcelain cleats		3,000,000 pr.
Single-wire glazed porcelain cleats for No. 10 wire		175,000 pr.
Porcelain tubes, 4-in. by 5/16-in. by 9/16-in. diameter		1,250,000
Round-head, blued globe wood screws, No. 10, 2¼-in.		6,400,000
Round-head, blued globe wood screws, No. 8, 1¼-in.		550,000
Round-head, blued globe wood screws, No. 8, 1½-in.		81,000
Ball cord adjusters		24,000
¾-in. friction tape, black		9,600 lb.
Strip solder		4,800 lb.

NOTE.—Item No. 7, single-pole snap switches, and item No. 11, 6-amp. plug fuses, include 5000 each for outside lighting. Item No. 10, single-pole cut-outs, is for outside lighting.

*Where catalog numbers of a single manufacturer are given, it is understood that materials of equivalent value of other manufacturers are acceptable.

and about the same number of shades, 150,000 cleat receptacles, 22,600 snap switches, 27,800 combined switches and plug cut-outs, 75,000 plug fuses, mostly for 10 amp., 3,000,000 pairs of two-wire unglazed porcelain cleats and 175,000 pairs of single-wire cleats, 1,250,000 porcelain tubes 4 in. (10.16 cm.) long with a 9/16-in. (1.43-cm.) hole, about 7,000,000 1¼-in. to 2¼-in. (3.81-cm. to 6.85-cm.) wood screws, 9600 lb. (4354 kg.) of friction tape, 4800 lb. (2177 kg.) of solder, and other items on a similar scale.

It is estimated that about 4000 cars will be required to transport all building materials to each cantonment, and while they are being delivered many more cars will be required to furnish the supplies needed for the workmen, who will number between 3500 and 5000, according to the condition of the work and the size of the cantonment. Furthermore, in order that the recruits may be accommodated as soon as they arrive large quantities of cantonment furniture will arrive before the construction is finished.

POOLING OF COAL AND OF ITS DISTRIBUTION RECOMMENDED

Large Shipments of Coal to Europe Likely to Be Embargoed by Executive Order—Government Ownership of Mines and Railroads Not Improbable

After a conference with President Wilson, the Federal Trade Commission has submitted to Congress a report, following months of investigation, recommending that the government shall establish pools providing for coal production and distribution and rail and water transportation. The commission declares in its report that the coal industry is paralyzing all the other industries of the country and that the coal industry itself is being paralyzed by the failure of the transportation industry.

The commission in its report confirms the investigation of newspapers all over the country which have taken the trouble to send correspondents and photographers to railroad terminals where long lines of empty coal cars have been found standing idle upon sidings and other tracks. Notwithstanding a recommendation of the commission to Congress, however, that legislation shall be passed providing for a limitation upon the export of coal, the Washington correspondent of the ELECTRICAL WORLD reports that President Wilson will undoubtedly give orders under the war powers which have been conferred upon him by Congress specifically preventing the shipment of coal to Europe in large quantities in future. Some of the private advices of the government are to the effect that coal is bringing as much as $70 a ton in Paris for the use of private industry.

Under the recently enacted espionage law there is a clause giving the President power to embargo any necessities. It is stated at the White House that coal and wheat are the two principal necessities upon which embargoes should be placed, and these embargoes are expected to be enforced by Monday morning as the result of a proclamation by the President. The report of the

Federal Trade Commission to Congress states that the present production of soft coal is 40 per cent under the possible maximum, the cause being the alleged railroad car shortage. There is a very interesting paragraph in the report of the commission to Congress recommending a pooling operation by the government to the effect that "the operation both of the mines and of the transportation agencies could be carried on by the present employees and officials, and after the war they could be returned unimpaired to private operation." This paragraph, it is said in Washington, will raise in Congress without doubt the question of government ownership, which is hovering around so many of the government war-time activities.

PROBLEMS THAT CONFRONT THE ORDER OF SONS OF JOVE

Relations of Central Office to League, Distribution of Four-Dollar Dues, and Question of Annual Meeting Discussed

At a meeting of the Past-Jupiters and the Fifteenth Congress of the Jovian Order with the representatives of some of the Jovian leagues at Chicago on June 12 and 13, the problems of the Jovian Order were discussed. Henry L. Doherty, Jupiter of the order, presided at the meetings.

The discussion revolved mainly upon the point of whether or not the distribution of the present four-dollar dues should be changed to increase the amount going to the local leagues. The question of decreasing the expense of the central office was given consideration.

Jupiter Doherty set forth a possible solution of the problem of the distribution of Jovian dues in a manner that would be satisfactory to all concerned. The suggestion was concurred in by all present and was turned over to a committee of five for further consideration.

Briefly the plan is as follows. It recognizes that it would be disastrous to contemplate any reduction of the proportion of the dues now going to the central office unless positive assurance can be given of a proportionate increase in membership. It aims to give some incentive to the local leagues to make a sincere effort to increase memberships by offering a reward commensurate with the results secured. The plan aims to accomplish this by making the maximum dues to the national office $4 and the minimum dues $2. The amount of dues paid by the local league to the central office shall then be determined by the number of Jovians in good standing represented in its membership. A bogie established for each league and based upon the population of its city would be set, and arrangements would be made so that the nearer the Jovian membership approached the bogie the nearer the league would approach the minimum per member, or two-dollar, dues which it would send to the national office.

The committee of five to which this suggestion has been turned over will analyze not only this plan but all other questions which came before the meeting and will make a complete report of its decision to a meeting of the Congress and Past-Jupiters to be called not later than Aug. 20, 1917.

The meeting decided that the annual convention of the Jovian Order will be held as usual within ten days of Oct. 15, but that all forms of entertainment will be omitted and the meeting be strictly a business gathering. It was also decided that attendance at the meeting will be promoted in every way possible consistent with the money available for the purpose. The place and date of the meeting will be selected by Henry L. Doherty, Jupiter.

TAX ON ELECTRICITY UNLIKELY AT PRESENT

Secretary of the Treasury May Have to Stipulate What the Administration Desires if Congress Is to Take Any Other Action

Indications in Washington at the end of the week are that there will be no tax upon electricity in the bill designed to raise $1,800,000,000 war revenue. Representative Lenroot of Wisconsin, who offered an amendment to the bill when it was in the House of Representatives to strike out the electricity tax as it was reported from the House ways and means committee, has told friends in Washington that his canvass of those who are for and against the proposed electricity tax in the House indicates that the proposal will fail. Representative Lenroot is also of the opinion that he will be able to convince members of the House of Representatives that a proposed tax upon any form of electricity, light, heat, power, or telephone, will inevitably be passed on to the ultimate consumer by the companies. In this view, it is understood in Washington, Mr. Kitchin, chairman of the House ways and means committee, is likely to concur. Mr. Kitchin is reported to have told friends privately that he doubts if either the committee or the House will sustain the proposal for the tax when the bill comes back to the House from the Senate. On the other hand, it is reported in Washington that Secretary McAdoo of the Treasury Department may insist upon some features of the proposed electricity tax, and in view of the fact that he is the mouthpiece of the administration in regard to all war revenues and expenditures, it is believed that the House ways and means committee will, in the final analysis, require Mr. McAdoo, possibly even the President himself, to say just what is wanted.

ELECTRICAL INDUSTRY TO THE FRONT IN RED CROSS DRIVE

Westinghouse, Crocker-Wheeler and Baltimore Consolidated Gas Contribute an Aggregate Total of More Than Half a Million

The Red Cross campaign for $100,000,000 is now well under way, almost half this sum having been subscribed up to Thursday morning. In this drive the electrical industry has come to the front in helping the Red Cross to secure the required sum.

While no definite information is at hand relative to the industry as a whole, the following subscriptions have been announced by the New York branch of the Red Cross:

Westinghouse Electric & Manufacturing Company, a dividend of one-half of 1 per cent on both its common and preferred stock, amounting to	$375,000
Crocker-Wheeler Company	80,000
Consolidated Gas, Electric Light & Power Company of Baltimore, Md.	50,000

PRIZE WINNERS OF THE 1917 WIRE-YOUR-HOME-TIME CONTEST

Society for Electrical Development Announces Names of Those to Whom Money Awards Are Made and Results of Campaign

G. M. Sanborn, president Sanborn Electric Company of Indianapolis, chairman of the "wire-your-home-time" committee, has announced names of the prize winners in the twelve-hundred-and-fifty-dollar prize contest conducted by the Society for Electrical Development in connection with the nation-wide house-wiring campaign, April 1 to May 15. While the campaign was participated in by hundreds of lighting companies and dealers, the prize contest was restricted to members of the society.

The society offered thirty-five prizes. They comprised $150 as first prize, $50 as second prize and five other prizes of $10 each, and were allotted to employees of member companies in cities of five classes as follows: Class A, under 15,000 population; Class B, between 15,000 and 50,000; Class C, between 50,000 and 100,000; Class D, between 100,000 and 500,000; Class E, 500,000 and over. A contract was construed as "a signed agreement with a new customer for wiring at least three rooms with four sockets or over, in a house already built, located along existing lines, and requiring no other than ordinary service connection."

The prize winners were:

CLASS A—CITIES LESS THAN 15,000

Prize	Name	Houses Wired	Watts Conn.
$150	R. L. Ralston, Manistee, Mich.	119	39,270
50	C. H. Van Gorder, Oelwein, Iowa	96	33,172
10	V. O. Stafford, Humboldt, Iowa	83	35,000
10	F. P. Gaireus, Ridgway, Pa.	69	28,980
10	G. P. Cox, Wilmerding, Pa.	46	25,000
10	S. A. Lipscombe, Bartelsville, Okla.	43	14,000
10	T. J. McGee, Duryea, Pa.	40	10,000
10	R. E. Martin, Kankakee, Ill.	40	18,150
	Total Class A.	536	203,572

CLASS B—CITIES 15,000 TO 50,000

$150	Fred Vos, Muskegon, Mich.	109	35,425
50	A. L. Dumire, Elmira, N. Y.	100	48,000
10	D. C. Calhoun, Springfield, Mo.	91	33,735
10	H. A. Pendergraph, Durham, N. C.	83	23,000
10	F. A. Root, Lockport, N. Y.	82	52,240
10	W. J. Graham, Joliet, Ill.	74	46,600
10	J. M. Killian, Perth Amboy, N. J.	64	51,700
	Total Class B.	603	290,700

CLASS C—CITIES 50,000 TO 100,000

$150	M. G. Sanders, Flint, Mich.	147	117,600
50	L. B. Brown, Chattanooga, Tenn.	72	36,000
10	H. E. Shelton, Wilmington, Del.	50	30,000
10	E. E. Fouratt, Trenton, N. J.	50	37,500
10	J. H. Clark, Bayonne, N. J.	40	30,000
10	C. B. Parks, Chattanooga, Tenn.	33	16,500
10	L. C. Dye, Chattanooga, Tenn.	25	12,500
	Total Class C.	417	280,100

CLASS D—CITIES 100,000 TO 500,000

$150	J. J. Montgomery, Syracuse, N. Y.	116	42,010
50	T. V. Carpenter, Cincinnati, Ohio	111	85,000
10	W. R. Adams, Newark, N. J.	68	65,400
10	J. M. Walsh, Scranton, Pa.	56	20,550
10	F. W. White, Cincinnati, Ohio	55	55,000
10	F. Reynolds, Scranton, Pa.	47	14,550
10	A. Rodenhuis, Grand Rapids, Mich.	47	30,180
	Total Class D.	500	322,690

CLASS E—CITIES 500,000 AND OVER

$150	R. A. Le Comte, Chicago	110	180,700
50	A. J. Kay, Chicago	108	119,150
10	F. T. Wing, Chicago	82	115,800
10	J. A. Gordon, Chicago	77	80,400
10	S. G. Powell, Chicago	61	97,700
10	F. L. Richardson, Chicago	59	48,300
10	W. K. Bridgman, Chicago	55	50,700
10	George Lovett, Philadelphia	55	73,500
	Total Class E.	607	716,250

In two classes there were two winners of the seventh prize, so that thirty-seven prizes had to be awarded. The thirty-seven prize winners wired 2663 houses, an average of seventy-two each, or an average of two houses during each working day during the contest.

The committee which had charge of the contest was: G. M. Sanborn, chairman, Sanborn Electric Company, Indianapolis; E. W. Lloyd, Commonwealth Edison Company, Chicago; A. L. Oppenheimer, Enterprise Electric Construction Company, Cleveland; H. C. Heidrich, Electric Motor & Repair Company, Newark; T. J. McManis, Edison Lamp Works, Harrison, N. J.; Elliot Reid, Westinghouse Lamp Works, New York; N. H. Boynton, National Lamp Works, Cleveland; E. W. Rockafellow, Western Electric Company, New York; Robert Montgomery, Louisville Gas & Electric Company; M. S. Seelman, Jr., Edison Electric Illuminating Company, Brooklyn; J. M. Wakeman, general manager Society for Electrical Development; H. W. Alexander, director of publicity Society for Electrical Development.

FURTHER REDUCTION IN RATES FOR PORTLAND (ORE.) COMPANY

Commercial Lighting and Heating Schedule Lowered Between 5 and 10 Per Cent by Order of Public Service Commission

Commercial lighting and heating rates of the Portland (Ore.) Railway Light & Power Company have been reduced between 5 and 10 per cent, effective July 1, 1917. The order of the Public Service Commission of Oregon calling for the new rates has just been issued and is the second of a series of rate orders resulting from the valuation of the property during the last three years.

The commission has acted on the theory that a reduction in rates will result in the Portland company retrieving some of the business that has been lost to the Northwestern Electric Company, as that concern has had lower rates in force than the Portland company tariffs.

That the commission does not view with approval the present unrestrained competition may be inferred from the following extracts from the findings:

"The commission in the former rate order took into account the existence, in the field covered by the respondent's light and power operations, of a competing electric utility, which, by service at lower rates in only a restricted territory of greatest business activity and density of population, has been able to attract a large percentage of the most profitable business from the respondent's system. The competitor has not been required to serve any except this most advantageous business and has left the respondent with the continuing responsibility to serve, without increased compensation, the outlying territory involving much greater expense per unit of service delivered.

"The sharp decrease in the electric revenues during the last few years, and the probability, under the inequality of rates which has existed, of continuing reductions, with consequent damage to the investors, has resulted primarily from this competition.

"In view of these existing conditions and other features surrounding the business of the respondent, including the practical and successful reduction of the value of service to the consumer by the competitor's

lower rate, the commission found that the charges under investigation, although not producing any excessive or even fair return on the investment, were, in some respects, unreasonable, and not such as ultimately to produce the greatest use of the service by the consumers or yield the greatest return to the investors in the property. Under these findings rates for residence lighting and commercial power were ordered.

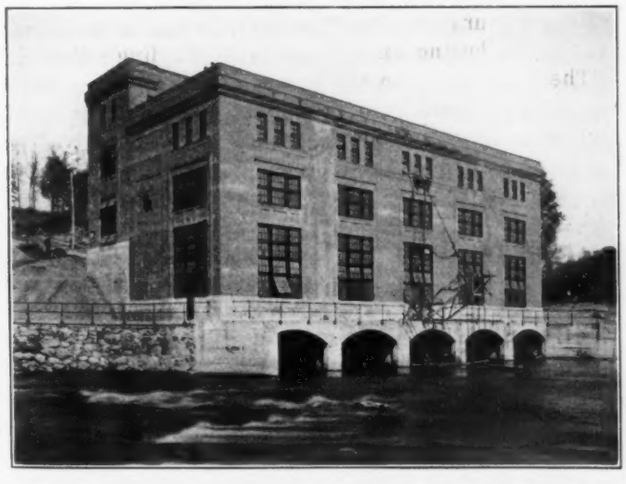
"The commission now further finds that these conditions apply with equal force to the present commercial lighting rates and that, in so far as the present schedule differs from that hereinafter set forth, such rates are unreasonable. The following commercial lighting rates will reduce to a minimum the effect of the elements hereinbefore discussed and, under the particular conditions surrounding the business, are just, reasonable and not unjustly discriminatory, either in themselves or in comparison with other rates established for this utility.

"It must be borne in mind that the following schedule is designed to meet purely local conditions. A peculiarity of expression has been introduced in the allowance of 1 cent per kilowatt-hour for a certain block of energy under the secondary rate. We believe this rate is correct in principle and the inclusion of this provision overcomes, without affecting the equitable application of charges, inequalities which arise from existing competition."

GROWING BUSINESS OF THE CONNECTICUT POWER COMPANY

Output of Electricity Practically Doubled in 1916, and Future Prospects for Development Are Excellent

The Stone & Webster Management Association, Inc., general manager of the Connecticut Power Company, says in the annual report of that company for 1916 that prospects for further growth are excellent.



FALLS VILLAGE POWER HOUSE OF CONNECTICUT POWER COMPANY

The general prosperity prevailing throughout New England continued to favor the territory served by the New London, Middletown and Housatonic divisions of the company. Total gross earnings increased approximately 29 per cent over 1915, and the balance after fixed charges was 33 per cent larger than a year ago. The output of electricity was practically doubled and sales of gas were 13 per cent in excess of the 1915 figure. Although operating expenses increased 24 per cent, net earnings show a growth of 34 per cent.

The Lyme Light & Power Company, which takes power at wholesale, has a constantly growing business.

EXTENSIVE PLANS FOR THE ARMY CANTONMENTS

Sites for the Camps at Which New National Army Forces Will Be Instructed—Call for Electric Service

The War Department is preparing to construct, the work to be finished by Sept. 1, sixteen cantonments in which members of the new National Army, raised by selective conscription, are to be instructed. It will also construct a number of National Guard camps. Sites for cantonments have been selected, as follows:

Ayer, Mass.; Wrightstown, N. J.; Columbia, S. C.; Atlanta, Ga.; Chillicothe, Ohio; Louisville, Ky.; Battle Creek, Mich.; Little Rock, Ark.; Des Moines, Ia.; Fort Riley, Kan.; Fort Sam Houston, Tex.; American Lake, Wash.; Yaphank, N. Y.; Admiral, Md.; Rockford, Ill., and Petersburg, Va.

Sites for the National Guard camps have been selected, so far, as follows:

Fort Worth, Tex.; Fort Sill, Okla.; Deming, N. M.; Waco, Tex.; Houston, Tex., and Linda Vista, Cal.

This construction work will be in charge of Col. I. A. Littell, U. S. A., Quartermaster Corps, Adams Building, Washington, D. C. Details are being worked out by the committee on emergency construction of buildings and engineering works of the Council of National Defense, which has brought to its aid a number of engineers, architects, town planners and authorities on construction. William A. Starrett of Starrett & Van Vlock, architects, is chairman of the committee.

Extension of the service of the Louisville Gas & Electric Company to the site of the Federal Army mobilization camp, which will serve as the place for assembling and training the men drafted in Kentucky and Indiana, is to be undertaken at once.

COMPETITION IS FELT BY WASHINGTON POWER COMPANY

Revenues from Electric Light and Power in Business District of Spokane Affected by Reductions to Meet Competition

In the annual report of the Washington Water Power Company for the year 1916 the following statements appear:

"The electric light and power revenues in the business district of Spokane were materially affected in the last four months of 1916 by reductions in rates, made necessary in order to retain the business in competition with a steam-heating company which has installed an electric power station operated by steam. The effect of these reductions will continue in 1917. Over 90 per cent of the business in the competitive district has been secured by your company.

"Lighting and power revenues in the country districts have shown an increase of 10 per cent over those of 1915."

MUNICIPAL PLANT ADVOCATES DEFEATED IN PORTLAND, ORE.

Election of George L. Baker as Mayor Believed to Show Unfavorable Attitude Toward Public Plant Project

In the election held in Portland, Ore., on June 4 the interests which have been contending for a municipal lighting plant were decisively defeated.

The two principal candidates for Mayor were Will H. Daly, representing the labor element, and George L. Baker, a lifelong Republican.

Mr. Baker was elected and an ordinance allowing unregulated use of the streets by jitney operators was overwhelmingly beaten. An ordinance requiring $2,500 bonds for jitneys was adopted by a very large majority. An ordinance against picketing was also adopted.

B. S. Josselyn, for many years president of the Portland Railway, Light & Power Company and well known in the industry throughout the United States, ran third on the ticket for Mayor.

It is believed that the election shows that the people do not look favorably at this time upon the agitation for a municipal lighting plant.

WAR-TIME ECONOMIC BENEFIT OF TRANSMISSION TIE LINES

In Hearing on Petition of Fall River Company to Construct 66,000-Volt Line Chairman Weed Discusses Concentration

At a recent hearing by the Massachusetts Gas and Electric Light Commission upon a petition of the Fall River Electric Light Company for authority to construct a 66,000-volt transmission line from Fall River to the Massachusetts-Rhode Island boundary in Seekonk, a discussion took place as to the economic advantages of high-tension power interchange between adjacent central station and hydroelectric transmission systems. As recently noted in the ELECTRICAL WORLD, the Fall River company has applied to the Massachusetts Waterways Board for permission to build a 66,000-volt crossing over the Taunton River at Fall River, and the general advantages of the plan of interconnecting the Fall River system with that of the Rhode Island Power Transmission Company were presented to the Waterways board by Philip Cabot, vice-president of the Fall River company. At the hearing before the Gas and Electric Light Commission the question of public convenience and necessity was taken up.

Mr. Cabot pointed out that it is planned to connect the Fall River system with that of the Narragansett Electric Lighting Company in Providence, the latter being interconnected with the Rhode Island Power Transmission Company and in this way tied in with the great system of the New England Power Company. Growth of business in Fall River has made immediate development of power facilities necessary, and it is estimated that a two-circuit steel-tower line of 40,000 kw. rating and allowing for the supply of 20,000 kw. with one line out of service can be built for about $300,000. Enlargement of the existing steam generating plant in Fall River by an addition of 15,000 kw. would cost about $1,250,000. Delivery of a turbo-generator of this size could not be had before the spring of 1919, and Mr. Cabot contended that the company is not in a position to finance such a steam-plant extension at this time. The present plant has an installed capacity of about 10,000 kw. The units have some overload capacity, and with one of the existing 4000-kw. machines out of commission about 7500 kw. could be carried. The peak load of December, 1916, was over 6000 kw. Last summer the company ordered a new unit of about 6000 kw. rating to take the place of a 1000-kw. machine, so that when this installation is completed the safe maximum capacity of the plant with the largest unit out of service will be about 9000 kw. It is anticipated that by the fall of 1917 the peak load on the station will be at least 9000 kw.

TIME-SAVING IN TRANSMISSION LINES

Fall River cotton mills, Mr. Cabot said, now use about 100,000 hp. in steam power; many steam plants are old. There is a strong tendency toward electrification of mills since war began, and high coal cost has accentuated this. The Fall River company's power load has virtually been doubled in the last year. Within a few weeks mill contracts have been awarded orally which will take about 3500 kw. from the central station company. The outlook for future business is largely from users of from 1000 kw. to 2000 kw. in mill service. The cost of adding two units of 15,000 kw. to the steam plant of the company, including all auxiliary equipment, building, boilers, etc., would be about $1,500,000. The proposed transmission line can be built in about a year, whereas it will require about two years to install and begin to operate the turbo-unit. A ten-year contract with the Rhode Island Power Transmission Company is under consideration.

The Fall River company believes that it would be a mistake to add units of 4000 kw. to 6000 kw. rating to the steam plant, as these would become obsolete with reference to demands upon the station almost before they were installed. A multiplicity of small units is much more expensive to purchase and more costly to operate than a larger unit, taking disproportionate space and exhibiting lower economy of operation. Cost of coal in Fall River to-day is more than double the normal price. The construction of the high-tension line will make it necessary to carry one spare unit for Providence and Fall River instead of two, the line being available for relay service at all times. On account of the large amount of underground construction which would be required, the interconnection of the Fall River and New Bedford stations has not appeared so desirable from the engineering standpoint as the building of the line to Rhode Island. The line will be about 14.5 miles (23.3 km.) long.

Mr. Cabot said that in case of a conflagration or explosion the steam plant could be put out of commission for perhaps three months, but two or three days would be the longest period of interruption possible for a transmission line. The New England Power Company is rarely short of water except in the summer, while in this period coal is easier to obtain at Fall River. By providing transformer banks in duplicate service continuity would be arranged for, and in case of trouble it would be a simple matter to transfer temporarily transformers from other points on the New England or Connecticut Valley 66,000-volt systems to Fall River. Transformers could be taken from the Connecticut Val-

ley in a week or less. In connection with all the high-tension lines in Massachusetts there is considerable spare transformer equipment which can be moved.

Opponents urged that Fall River taxable property would not be increased unless a new steam-plant extension were built. Mr. Cabot said that it would cost 50 per cent more to build a station addition than three years ago. Ultimately a large station will have to be built in Fall River, but with present excessive costs the company prefers to spend one-quarter as much and secure additional energy by transmission line.

POSSIBILITIES OF CONCENTRATION

Chairman Weed pointed out the great waste in the erection of many scattered plants and that the possibilities of economical production by concentration are very great. Anybody who can bring cheaper power into a manufacturing community, Mr. Weed said, is doing a great public service, and the cheaper it is brought in, the better it is. The aggregate generating capacity of electricity supply companies in the State is at least 40 per cent greater than actual demands upon them, and some plants necessarily, in order to be safe in taking care of the demands placed upon them, have to be developed to a greater degree than is absolutely essential if they can be relayed from some other source. Mr. Weed recognized that any city would like to secure tax returns, but pointed out that any introduction of power at lower cost is a public benefaction and noted that there has been a disposition to sell local utility properties when the resident owners have been offered what they considered a proper price for their holdings. Desirable as control of central stations by local interests would be, development often requires outside capital.

RELATIONS BETWEEN N. E. L. A. HEADQUARTERS AND SECTIONS

George B. Muldaur, Field Secretary, Completes Tour of United States and Canada—Result Is Closer Co-operation

George B. Muldaur, field secretary of the National Electric Light Association, has just completed a tour of the United States and Canada, during which he has represented the association at the conventions of five geographic sections and at executive meetings and conferences with the officers of eight others, discussing and reporting suggestions for the improvement of service and the betterment of relations. He has visited fifty member companies where local sections exist, attending their meetings and assisting them in taking full advantage of the educational opportunities offered by the association. He has also been instrumental in the formation of twelve new company sections and the reorganization of seven others which had become inactive.

The trip has resulted in a closer understanding and sympathy between the national body and the affiliated and kindred organizations throughout the country, and has supplied association headquarters with a mass of first-hand information regarding the problems and requirements of individual sections, localities and members. This service is being followed up with a view to keeping all geographic sections, associations and individual company members in close personal touch with the national body for co-operative effort.

G. H. STICKNEY ELECTED PRESIDENT OF THE I. E. S.

Council Confirms the Selection for the Fiscal Year 1917-1918—Officials of the Various Sections Are Also Approved

Election of the following officers of the Illuminating Engineering Society for the fiscal year 1917-1918 was confirmed by the council on June 14:

President, G. H. Stickney; vice-presidents, W. G. Hoyt and C. E. Stephens; general secretary, Clarence L. Law; treasurer, L. B. Marks; directors, R. F. Pierce, S. C. Rogers and P. S. Young.

GEORGE H. STICKNEY
President-Elect of Illuminating Engineering Society

The election of the following section officers also was confirmed at the meeting:

New England Section—Chairman, S. C. Rogers; secretary, M. R. Pevear; managers, J. W. Cowles, David Crownfield, C. A. B. Halvorson, R. G. Hudson and George P. Smith, Jr.

New York Section—Chairman, A. S. McAllister; secretary, Norman D. Macdonald; managers, D. F. Atkins, S. B. Burrows, W. J. Clark, Alexander Maxwell and A. L. Powell.

Pittsburgh Section—Chairman, L. O. Grondahl; secretary, W. P. Hurley; managers, E. J. Edwards, L. J. Kiefer, Harold Kirschberg, J. L. Minick and H. N. Muller

Philadelphia Section—Chairman, Walton Forstall, secretary, Unit Rasin; managers, John R. Hare, J. B. Kelley, H. H. Ganser, G. B. Regar and C. W. Wardell.

Chicago Section—Chairman, E. H. Freeman; secretary, James J. Kirk; managers, C. A. Carpenter, Alfred O. Dicker, A. H. Meyer, Fred A. Rogers and J. L. Stair.

G. H. Stickney, the new president, was born in Buffalo, N. Y., in 1872. He was graduated from Cornell University with the degree M.E. (E.E.) in 1896, and immediately afterward went to the General Electric Company's works at Schenectady, where he spent one and a half years in the student course. Following this he acted as first assistant to W. D'A. Ryan in charge of the lighting department of the works at Lynn, Mass. At this time his work consisted of factory, commercial and engineering development of the arc lamp. Later he was instrumental in the development of the high-efficiency incandescent lamps and equipments. The next two years were spent by Mr. Stickney as the first assistant to Mr. Ryan in similar work at the Schenectady plant.

In May, 1911, Mr. Stickney took charge of illuminating engineering of the Harrison works of the General Electric Company as assistant to the sales manager. At this plant he developed a number of lighting appliances and collaborated in designing many more.

Numerous company publications and many articles and papers on illumination which have been published from time to time in various technical journals have been writen by Mr. Stickney. He has served on many committees in different societies, whose functions dealt with work having a bearing on illumination. In the I. E. S. he has served as secretary (charter) New England Section; chairman New York Section, 1911 (two years); vice-president, chairman of committee on papers and general secretary.

SECURE GOVERNMENT DEPOSITS BY PUBLIC UTILITY BONDS

Direct First Mortgage Listed Obligations on Physical Property Acceptable as Collateral at 75 if Yielding 5½ Per Cent or Less

A revised list of the classes of approved securities which will be accepted by the Treasury Department as collateral security for government deposits of funds in connection with the Liberty Loan bond issue was announced by Assistant Secretary Oscar T. Crosby on June 12. It includes public utility as well as other classes of securities.

Among the securities now approved are:

"Bonds of electric railway and traction companies, of telephone and telegraph companies and of electric light, power and gas companies, secured by direct mortgages upon their physical properties in the United States and listed on some recognized stock exchange, taken at 75 per cent of the market value thereof, not exceeding par, but not including any such bonds which on May 29, 1917, were at a market price to yield more than 5½ per cent per annum, if held to maturity, according to standard tables of bond values."

At least 25 per cent in value of the securities deposited by any bank or trust company to secure its deposits must consist of bonds and certificates of indebtedness of the United States government of any issue, including bonds of the Liberty Loan and interim certificates for payments therefor, all at par.

The Secretary of the Treasury reserves the right to call for additional collateral security at any time.

W. E. Stanley, Chicago, representing E. W. Clark & Company of Philadelphia, protested on June 4 to Secretary of the Treasury McAdoo against the original circular dated May 29, which did not include public utility bonds among the securities acceptable as collateral.

ELECTRIC POWER CLUB TENDERS ITS RESOURCES

In Full Sympathy with the Objects of the War, It Offers Loyal Support and Assistance to the President

Clarence L. Collins, 2d, president of the Electric Power Club, has sent to President Wilson, by unanimous vote of the members, the following resolutions passed at the meeting held at Washington on June 11 and 12:

Whereas the United States is now engaged in a great war in which it participates only for the purpose of lending its aid to establish and safeguard the democracy and peace of the world, and

Whereas the Electric Power Club, representing the electrical machinery manufacturers of the nation, is in full sympathy with the objects of this war, and desires to lend its best assistance and effort toward a speedy and successful conclusion of the conflict, be it

Resolved, That the Electric Power Club, being now in convention assembled, does hereby tender to the President of the United States the loyal support and assistance of its officers, committees and members, together with the facilities and resources at its command, all to be made available to him when and as he may require the same; and be it further

Resolved, That, in order to facilitate the making and fulfilling of any demand on the Electric Power Club for such assistance as it may be prepared to render the government, a committee, to be known as the Electric Power Club committee of national defense, be at once created, consisting of two executive members and the president of the club, the latter as chairman of the committee, through which the officers of the government may be promptly and effectively brought into contact with the officers and working committees of the club and all manufacturers who are members thereof.

Other business transacted at the meeting, in addition to that reported in last week's issue of the ELECTRICAL WORLD, page 1173, was:

A suggestion for publishing the Electric Power Club book of standards in foreign language for distribution to Central and South America was favorably acted upon.

A resolution was also passed covering the purchase of Liberty bonds with the surplus cash now in the bank.

COMMITTEE TO SURVEY CALIFORNIA OIL RESOURCES

President Thelen of the Railroads Commission Is Chairman—Industrial Development and National Needs Lead to Action

The extent to which fuel oil has replaced coal on the Pacific Coast makes oil supply a matter of great importance. Governor Stephens of California has selected two members of a committee of three to obtain facts and make recommendations relating to production, distribution and utilization of petroleum. The committee is to study measures to be taken to meet emergencies arising from war and to increase production and most effective utilization of these resources of the State.

Max Thelen, president State Railroad Commission, will be chairman of the committee, and Prof. David M. Folsom of Stanford University is a member. Experts

of both the Railroad Commission and the State Mining Bureau are to assist the committee.

Oil companies state that the supply of oil held in storage has been decreasing rapidly. There was a daily decrease in the storage during 1916 of 35,800 barrels, and in the first three months of this year the rate of decrease has been considerably greater.

ENGINEERING COUNCIL TO SPEAK FOR ENGINEERS

Appointment of Members of the American Institute of Electrical Engineers to New Organization Is Announced

Steps have been taken to form an engineering council to speak for engineers in general upon subjects of common interest to engineers and the public. As representatives of the American Institute of Electrical Engineers the following have been appointed: H. W. Buck, E. W. Rice, Jr., N. A. Carle, P. Junkersfeld and C. E. Skinner.

Amendments to the bylaws of the United Engineering Society have been adopted to provide for the engineering council as a new department of that society. Each founder society shall have five representatives upon the council; the United Engineering Society shall have four representatives.

HOLD SCIENTIFIC MEETINGS MORE FREQUENTLY IN WAR

Dr. Colin G. Fink, President American Electrochemical Society, Urges the Great Stimulus of Professional Discussion as War Measure

Dr. Colin G. Fink, Edison Lamp Works, Harrison, N. J., president of the American Electrochemical Society, makes the following statement:

"A number of our scientific societies have deemed it advisable 'on account of the war' to either cancel or postpone their future meetings and conventions. The American Electrochemical Society disapproves of this action and at its recent board meeting adopted resolutions encouraging rather than discouraging the holding of meetings.

"Modern warfare is not so much a matter of prowess at arms as it is a stupendous engineering undertaking. To hasten this war to an early and victorious close our many thousand engineers must bring to bear every possible effort. However, individual, independent effort is not desirable at this time; concerted action is absolutely essential for the most efficient service.

"In order to expedite the solution of many of the new problems that have arisen as a direct consequence of our martial state, unrestricted discussion of the problems (with but few exceptions) at scientific meetings is bound to give all of us a clearer understanding of the real points at issue, of the urgent needs of our country at this momentous hour.

"Meetings of scientific and technical societies have ever served as a great stimulus for their members and have been a 'clearing house' for many of the best thoughts and ideas of our professional men.

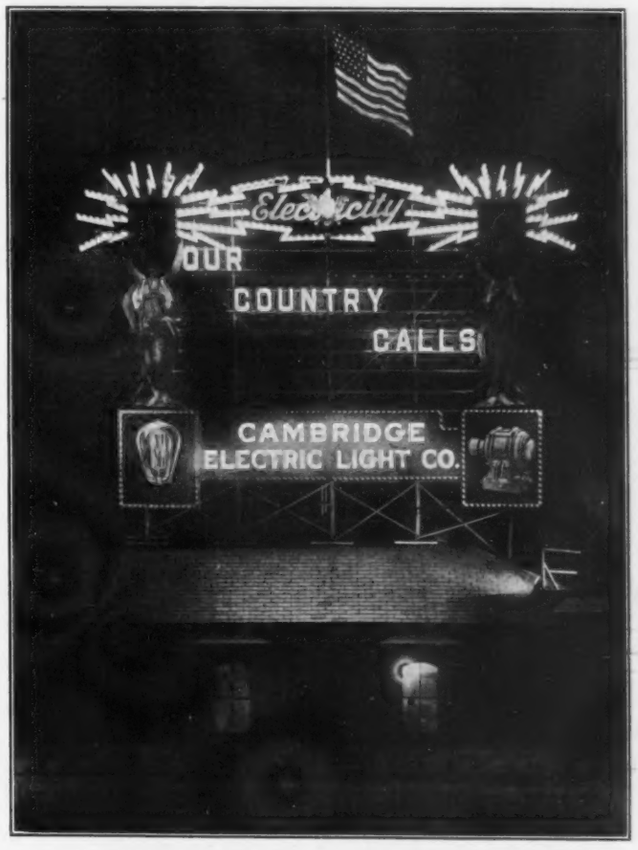
"Let us follow the good example set us by England. Let us encourage rather than discourage the holding of scientific meetings in these war times. When England found herself confronted with a very serious shortage of sulphuric acid, glass, dyes, electrodes, brass, furnaces, etc., the scientific societies arranged symposiums on these subjects and not only invited all of the members to attend but, further, urged those factory men who were not members to come to the meetings to give their views and experiences and to learn all they could in return.

"Just as a large business corporation depends upon the organized effort and efficiency of the several units and departments, so does our government, now more than ever, look to the organized concerted effort of its large engineering bodies for quick and efficient results. Let us continue holding our meetings and hold them more frequently than ever before."

PATRIOTIC ELECTRIC SIGN SHOWN IN CAMBRIDGE, MASS.

Central Station Company Displays Large Sign to Meet Public Sentiment of Loyalty to Our Country

The Cambridge (Mass.) Electric Light Company is devoting one of the largest electric signs in the Greater Boston district to patriotic service. The sign is on the



CAMBRIDGE COMPANY ADVERTISES PATRIOTISM

roof of a building in Central Square, the most densely populated business section. It is about 40 ft. wide by 24 ft. high (12 m. by 7.2 m.). It is provided with a four-line interchangeable center with female figures at each end, with corner shields between which the word "Electricity" is formed. Lightning is simulated by the use of a flasher requiring about 1300 10-watt lamps.

FORM OF ANNUAL REPORT FOR THE PENNSYLVANIA COMPANIES

At Conference in Harrisburg Chairman Ainey of the Pennsylvania Commission Asks the Judgment of Representatives of the Electric Utilities

A conference with representatives of electric companies on the subject of a form of annual report was held by the Pennsylvania Public Service Commission at Harrisburg on June 6.

The commission prepared a tentative draft of a form of report. This was filed with the Pennsylvania Electric Association before the hearing and other copies were available at the commission office. At the hearing the Pennsylvania Electric Association represented member companies.

In opening the conference the chairman, Commissioner Ainey, said:

> Gentlemen, the Public Service Commission is indebted to you for your compliance with our request that you attend this conference for the purpose of giving us, from your experience, your comments concerning the program which the commission has in mind with respect to the promulgation of an order calling for reports from certain classes of utilities, of which you are representatives.
>
> We have therefore asked you to come and sit with us for the purpose of discussing all features incident to the promulgation of a series of reports which seem to be called for by the terms of the public service company law and which are calculated to aid us in carrying on the work of the Public Service Commission.
>
> Let me say to you that we do not wish you to feel that this proceeding or this conference is in the nature of an adverse proceeding. We are inviting you here for the purpose of getting the benefit of your judgment, which, put together with the experience of our accounting force, will enable us to ascertain how any order that might be made will be least burdensome upon the utility companies and most serviceable to the public at large, and with your aid the Public Service Commission, through its officers and bureau chiefs, may be able to solve this problem. So we invite your fullest expression and your freest criticism upon any features of this matter. In order to aid us, there has been tentatively prepared a report which represents a great deal of study on the part of the chief of our bureau of accounts, but we are not saying to you that it is perfect or that it is to be adopted in just exactly the form in which it is presented. We realize that it is subject to careful examination and perhaps modification.

Following the conference the commission has taken the matter under advisement. No form has yet been adopted.

NEBRASKA POWER COMPANY ACQUIRES THE OMAHA SYSTEM

Extension of Transmission Lines Into Outlying Territory a Feature of the New Plans for Development

The plant and property of the Omaha Electric Light & Power Company has been acquired by the Nebraska Power Company. Extensions will be built into the territory near Omaha. An official announcement says:

"Serving a territory 100 miles from the central station in Omaha is within the expectation of the men who are directing this new forward movement of the company."

Officers and directors of the Nebraska Power Company are: George H. Harries, president; W. D. McHugh, vice-president and general counsel; Ward M. Burgess, vice-president; J. E. Davidson, vice-president and general manager; S. E. Schweitzer, secretary and treasurer; T. C. Byrne, Gould Dietz, G. W. Holdrege, Joseph E. Barker, J. H. Millard and C. E. Yost.

FAIR TO INCREASE RATES OF LARGE INDUSTRIAL CONSUMERS

L. P. Hammond of William P. Bonbright & Co., Inc., Says That Burden of Higher Operating Costs Will Fall Upon Large Users

L. P. Hammond of William P. Bonbright & Company, Inc., New York, vice-president Colorado Power Company, says:

"It is apparent that if operating expenses increase in fairness the rates paid by the large industrial consumers must be correspondingly increased.

"That the inherent police powers of the state are such that no contract can stand against the authority of a public utility commission to increase or decrease rates has been so firmly established in the courts as to nullify any argument that contracts with large industrial consumers will prevent increase of their rates.

"There is therefore every reason to anticipate that public utilities will materially increase their gross revenues through increase of rates to large industrial consumers; that not only is this possible, but it is highly probable that the commissions will compel it.

"The commissions are coming to realize that, no matter how much of a necessity public service is for the small user, it is not a necessity for the large industrial user who can always exercise his alternative of operating his own plant.

"This being the case, no political agitation or disturbance will result, since the burden of the increased cost of operation will rightfully fall upon the relatively few large industrial consumers instead of upon the many small users.

"Now all the factors bearing upon the increased operating cost of the utility bear with equal force upon the cost of producing electricity or gas in isolated industrial plants. It goes without saying that utilities are far ahead of the average isolated plant in the use of modern, economical equipment. It follows that the increased cost of fuel and labor will be more serious in small isolated plants with more or less obsolete equipment than it will with the utilities. The result will be to force many power prospects who have, for one reason or another, hitherto declined to use central station service over to that service. In this way, despite increased rates, the utilities can anticipate an increase of revenue.

"This is of equal importance in answering the argument that industrial users will put in their own plants if the central station rates are increased. But here there is the added fact that the present high cost of machinery and difficulty in obtaining reasonable deliveries thereupon will militate against abandoning central station service.

"Finally, we are aware of notable instances where large consumers have already acquiesced in increased rates in recognition of the situation and of the impossibility of obtaining public service to the detriment of the small consumer."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Injury to Shade Trees.—A telephone company is not relieved from liability for damages to a property owner for unlawfully cutting his shade trees, it is held by the Supreme Court of Iowa (162 N. W. 612), because of the fact that the company's servants did no more cutting than in the exercise of their honest judgment they thought necessary and proper. If the honest judgment of the agents of defendant was in fact faulty, it and not the plaintiff must suffer the consequences of the mistake in judgment.

Modification of Contracts.—Where an electric power company and a town contracted that the power company should furnish the town with electrical energy for lighting at the lowest rates given any other town, the contract containing nothing which prevented the town from changing the form and substance of the contract or from making an entirely new contract upon the same subject, the company and town could make a new contract for a fixed rate per lamp, the Supreme Court of North Carolina held in the case of Southern Pacific Utilities Company versus town of Bessemer City (92 S. E. 331). Where an electric power company and a town with which it had contracted to furnish energy for lighting at the lowest rate given any other town five years later made another written contract wherein every detail was provided for without reference to the first contract or any of its stipulations, the latter contract stating that the prior contract was canceled and annulled except to enable the power company to collect what was then due it by the town, the power company and the town made a new and entire contract for the future, canceling the previous one.

Negligent Placing of Lines.—A complaint charging that a city operating an electric lighting plant strung wires of high voltage negligently through the lower branches of a small tree where wires might injure children who should climb the tree not knowing the danger, and that the wires were insufficiently insulated, and that the city knew or could have known of the condition in time to have remedied it, and that the plaintiff climbed into the tree and was burned by the wire, is sufficient, after verdict, to sustain judgment for plaintiff, it was held by the St. Louis Court of Appeals (193 S. W. 971). An electric company maintaining a dangerous wire near a tree is bound to anticipate that persons may lawfully climb the tree and must exercise due care to prevent injuries. Where a boy climbed a tree after a bird's nest and a limb of the tree broke, throwing him against a high-voltage electric wire which was insufficiently insulated and negligently placed, the proximate cause of his injuries was negligence and not the breaking of the limb of the tree. To charge the city with negligence in placing its wires it is not essential that it could have known that the precise injury would happen as it did, but it is sufficient if the city should have anticipated that some injury might result, and that plaintiff's injury did result as a natural and probable consequence. In action for injuries to minors by electric light wires, instruction authorizing jury to find that the tree through which the wires were strung was an object likely to attract children, and that the city knew or by the exercise of ordinary care could have known that children might climb the tree, was proper where the tree in question was a small tree with branches only a few feet from the ground.

Capitalization of Public Utility.—Findings of the Public Service Commission are considered prima facie correct on appeal, but the court will consider the relative weight of the evidence in the record, the Supreme Court of New Hampshire held in the case of Grafton County Electric Light & Power Company (100 A. 668). A public utility corporation may capitalize what it owns, but can charge rates only on basis of such property as is devoted to the business in hand. When increasing capital stock of a public utility corporation, where securities are to be sold, in determining the value of its property the amount which a prudent investor would pay at date of proposed capitalization, including all elements of value, such as cost of reproduction less depreciation, investment cost and future returns under customary rates, and looking at the plant as a going concern, will be considered. Although no market value of an electric light and power plant exists in the ordinary sense, the items composing the plant have separate market values, but their total with cost of combination will be the reproduction cost, which decreased by depreciation is properly considered as indicative of value. An isolated sale of an electric plant with no competition is not conclusive as to its value, and it is immaterial whether a profit was made by the transaction. The method of water-power valuation by comparison with expense of operation by steam of an electric plant, although correctly determining amount of owner's damages if water power is taken away, is no test of price as a part which would be paid for it of a purchase of whole plant, in view of finding that other water-power might have been secured. Where electric company purchased another plant, its increased capitalization may include value of plant, including expense of additions and improvements and legal expense of organization, including expense of litigation, before the Public Service Commission and on appeal, and the mere fact that the expense will be large is immaterial and does not alter the principle that is involved in ascertaining the correct basis of capitalization.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Street-Lighting and Domestic Lighting Contracts.—The Pennsylvania Public Service Commission has handed down an order revoking the proposed contract for street and domestic lighting made by the borough of Girardville with the Schuylkill Electric Company for ten years. The commission says: "Inasmuch as the contract for street lighting and the contract for domestic lighting are inseparably connected, we are of the opinion and find and determine that it is neither necessary nor proper for the service, accommodation, convenience and safety of the public that either of the contracts above mentioned be approved. In the present case the commission would approve the street-lighting contract entered into by the borough and the applicant if the same had not been bound up with the contract for domestic lighting."

Accounts in New York.—A decision has been rendered by the New York Public Service Commission, First District, as to conformity with the commission orders relative to a uniform system of accounts and the form of annual report for the year 1915 on the part of the New York Edison Company, United Electric Light & Power Company, New York & Queens Electric Light & Power Company and Edison Electric Illuminating Company of Brooklyn. Among the points are: "Held, that the proposition that meaningless property accounts carried on the books of public utility corporations prior to the establishment of the uniform system of accounts should be combined with accounts representing cash cost and identifiable with specific property cannot be entertained by the commission except where the records have been properly kept, in which case the accounts may, with the approval of the commission, be reclassified on the basis of the uniform system of accounts and the old capital account eliminated. . . . Objection to the term 'depreciation' in the uniform system of accounts and the substitution for depreciation charge of a charge representing the amount estimated by the company to be necessary to equalize the average annual cost of property withdrawn from the service will not be approved, because small profits would tend to defer necessary charges and because the method adopted by the commission for depreciation charges is in entire agreement with decisions of the courts. . . . Where a fixed amount for depreciation is allowed by the commission in a rate case, such amount is paid by the consumers in rates and should be charged to reserve for depreciation."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

American Cities Company Passes Preferred Dividend.—The usual semi-annual dividend of 1½ per cent on the preferred stock of the American Cities Company has been passed.

Northern States Stock Sales in Home Territory.—During May 188 customers in the territory served by the Northern States Power Company purchased $82,500 of the preferred stock, making a total of $1,652,100 of this issue held by 3298 shareholders.

Westinghouse Stockholders Approve Merger.—At the annual meeting of stockholders of the Westinghouse Electric & Manufacturing Company at East Pittsburgh on June 13 the merger with the Westinghouse Machine Company was approved unanimously. Westinghouse Machine Company stockholders approved the merger on the same day.

Water Power Committee in West Virginia.—Governor Cornwell of West Virginia has appointed the following water power committee provided for by the recent Legislature: Frederick Fox, Sutton; C. C. Coalter, Hinton, and Wells Goodykoontz, Charleston. Investigations will be made of State water power and recommendations for proper legislation.

Patriotic and Welfare Work of Southern Sierras Company.—A plan of aiding in war measures and assisting employees in carrying their risks and burdens has been worked out by the Southern Sierras Power Company and associated and interconnected companies. Life insurance, Liberty bond subscriptions, reemployments and employees' savings are embraced within the measures which have been adopted.

Sandusky Company May Furnish Electricity for Municipal Pumping Station.—By the enactment of a law at the last session of the Legislature, central stations in Ohio are now in a position to make contracts with municipalities for pumping the city water supply. On application, the city commission of Sandusky, Ohio, by unanimous vote adopted a resolution allowing the Sandusky Gas & Electric Company to make an engineering investigation as to whether or not the company could furnish power for pumping water at the central water station at a less price than the city is able to do this.

Summer Session of College of Engineering, Wisconsin.—The nineteenth annual summer session of the College of Engineering of the University of Wisconsin will be held at Madison during the six weeks' period beginning June 25, 1917. Special courses will be given in chemistry, electrical, steam and hydraulic engineering, gas engines, machine design, mechanical drawing, mechanics, shop work and surveying. All courses given in the university summer session are open to engineering students. Special courses have been arranged for engineering, manual arts and vocational teachers. For information address F. E. Turneaure, dean, Madison, Wis.

Jovian Order Remits Dues of Enlisted Members.—Announcement is made by the Jovian Order that dues of members who enlist in the military service of the United States or any of our allies will be canceled during the war. Enlisted members will be carried on an "honor membership roll" without cost to them. Their cards, magazines and other Jovian material will be forwarded to them at the front and elsewhere whenever possible. The central office has requested all leagues to report enlistments promptly. Members are also requested to report their enlistment and where possible keep the central offices posted concerning their mail addresses.

Westinghouse Company Raises Wages.—The Westinghouse Electric & Manufacturing Company recently announced to its employees another advance in wages amounting to 10 per cent. This affected all workmen in the shop and practically all of the office force except a few higher-salaried employees. It was one more of a number of raises in wages granted to shop workmen which represent a general increase in two years of practically 40 per cent. The Westinghouse company has never made a practice of granting horizontal raises to the entire force, but has rather pursued the policy of granting increases to cases of individual merit, basing them on individual accomplishments.

Improving Shop Lighting in Wisconsin.—A committee to assist the Wisconsin Industrial Commission in revising orders relating to shop lighting has been announced by the commission. F. M. Wicks of the Westinghouse Lamp Company of Milwaukee has been invited to serve as chairman, and John A. Hoeveler, deputy of the commission, will be secretary. Other members are: Fred Schwarze, Pfister-Vogel Leather Company; Richard Finn, Cutler-Hammer Manufacturing Company; Howard Ilgner, Bureau of Illumination Service; Max Freschl, Holeproof Hosiery Company; George F. Rohn, electrical contractor, and H. G. Monger, Milwaukee Electric Light & Railway Company. At least one prominent oculist will be added later. This committee has been appointed to give Wisconsin an up-to-date shop-lighting code, similar to codes adopted recently by New Jersey and Pennsylvania. It will draft minimum standards for both natural and artificial lighting in industrial plants. With the desire of helping manufacturers to solve this problem it has also prepared a bulletin on industrial lighting, which will be available for distribution soon. The commission announces that it has made arrangements with the United States Public Health Service to detail one of its experts to Wisconsin, to study shop lighting and suggest improvements. The Public Health Service has detailed David M. Tuck for this work.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

National Electrical Credit Association.—On June 28 and 29 the National Electrical Credit Association will hold its eighteenth annual meeting at Boston, Mass. An interesting program of papers has been prepared.

New York Electrical Society.—The annual meeting of the New York Electrical Society for the election of officers was held June 14. The result of the election was as follows: President, Dr. A. S. McAllister; vice-presidents, J. F. Carey, Walter Neumuller and George H. Barbour; secretary, George H. Guy; treasurer, Thomas F. Honahan.

Convention of Pennsylvania Contractors.—The Electrical Contractors' Association of Pennsylvania held its annual convention and electrical show in the Hotel Adelphia, Philadelphia, June 19 to 21. Among the speakers at the first day's session were J. B. McCall, president Philadelphia Electric Company, who spoke on "The Central Station's Message;" Washington Devereaux, chief Philadelphia Underwriters' Electrical Department, "The Practical and Ethical Aspects of the Electrical Business;" J. W. Hooley, contracting electrical engineer, New York, "The Necessity for Competent Estimating;" Frank H. Stewart, F. H. Stewart Electric Company, Philadelphia, "The Manufacturer's Territorial Sales Agency;" H. W. Alexander of the Society for Electrical Development, "Selling the Electrical Idea," and C. M. Ripley, "Floodlighting." M. Edwin Arnold, Philadelphia, is president of the association, and M. G. Sellers, Philadelphia, is secretary-treasurer.

Managing Committee of Canadian Electrical Association.—At the recent annual meeting of the Canadian Electrical Association, held in Montreal, the Class A members of the association elected the following members to the managing committee: John W. Lieb, ex officio; P. T. Davies Civic Investment and Industrial Company, Montreal; M. C. Gilman, Toronto Electric Light Company; James Gould, Citizens' Electric Light Company, Smith Falls, Ontario; H. M. Hopper, St. John (N. B.) Railway Company; E. L. Milliken, Cape Breton Electric Company, Sydney, N. S.; Louis Pratt, Dominion Power & Transmission Company, Hamilton, Ontario; James B. Woodyatt, Southern Canada Power Company, Quebec; W. H. McIntyre, Ottawa Light, Heat & Power Company; R. J. Beaumont, Public Service Corporation of Quebec; A. P. Doddridge, Quebec Railway, Light, Heat & Power Company; P. Ackerman, Toronto Power & Light Company; C. S. Bagg, Civic Investment & Industrial Company, Montreal.

D. H. M'DOUGALL

Men of the Industry

Changes in Personnel and Position—Biographica' Notes

Douglas H. McDougall of the Toronto (Ontario) Power Company, who was recently elected fourth vice-president of the National Electric Light Association, was re-elected president of the Canadian Electrical Association at its recent annual meeting. Mr. McDougall, who was born in Toronto in 1874, is treasurer of the Electrical Development Company, the Toronto & Niagara Power Company, and the London (Ontario) Electric Company. He received his early experience in accounting in the United States, and returned to Canada in 1893 as treasurer of the Electrical Development Company of Ontario, Ltd. This company was leased in 1908 to the Toronto Power Company, and Mr. McDougall was appointed assistant to the general manager, and when in 1911 the Toronto company purchased the Toronto Electric Light Company he became assistant to the manager of the enlarged organization.

G. R. C. Wiles, Charleston, W. Va., has been appointed a member of the Public Service Commission to succeed Elliott Northcott, whose term expired June 1.

Samuel Insull, president of the Commonwealth Edison Company, Chicago, last week received the degree of doctor of science from Union College, Schenectady, N. Y.

Peter Junkersfeld, assistant to the vice-president of the Commonwealth Edison Company, Chicago, has been appointed a major general and has reported to Washington for duty.

H. C. Berry, who was district superintendent of the Electric Company of New Jersey at Salem, is now engaged in high-tension construction work with the American Railways Company, Philadelphia, Pa.

Professor Boris Alexandrovitch Bakhmeteff, head of the Russian commission to the United States, is a hydroelectrical engineer of considerable experience both in the United States and Russia. After receiving his engineering degree, he became instructor in the Petrograd Polytechnical Institute, and later professor. About thirteen years ago he came to the United States to acquire experience.

L. Scott Schilling has been appointed superintendent of the Electric Company of New Jersey in the Salem district, succeeding H. C. Berry.

Dr. A. S. McAllister, electrical and illuminating engineer and former editor of the ELECTRICAL WORLD, was elected president of the New York Electrical Society at the recent annual meeting.

L. S. Small, formerly with the Texas Power & Light Company, Dallas, Tex., has been appointed manager of the Concordia (Kan.) Electric Light Company, a subsidiary of the Commonwealth Light & Power Company.

Capt. Gustave Paul Capart, a member of the general staff of General Pétain, commander-in-chief of the French armies, and formerly of Brown-Boveri, a Swiss electric manufacturing company, and still sub-director of the Société Générale de Condensateurs de Fribourg, is in the United States for three or four months, attached to the French scientific mission as General Pétain's representative to see what electrical material can be made here to serve the French army. His headquarters are with the French Embassy at Washington. Captain Capart has been a frequent contributor to the European press, besides being a writer on electrical subjects.

A. G. Carson has been appointed manager of the Eastern Wisconsin Electric Company at Fond du Lac, Wis., in charge of the electric and gas departments at that place. Mr. Carson began his public service work with the Grand Rapids, Grand Haven and Muskegon interurban lines in the power and transportation departments. Leaving Michigan, he became connected with the Winnebago Traction Company at Oshkosh as chief engineer, and when that company was consolidated with the Eastern Wisconsin Railway & Light Company he was sent to Fond du Lac as superintendent of the electric department, which position he has filled for the last eight years. For the last year he has also been superintendent of the gas department.

Obituary

Sidney W. Winslow, president of the Beverly (Mass.) Gas & Electric Company, and also founder and chief executive of the United Shoe Machinery Company, died at Beverly June 18. He was sixty-two years of age, and was also president and a director of the Newburyport (Mass.) Gas & Electric Company and other gas and industrial organizations.

S. J. DILL

Samuel J. Dill, vice-president of the United Gas & Electric Engineering Corporation, died at his home in Jamaica, Long Island, N. Y., June 14. Mr. Dill was born in Wallkill, N. Y., Oct. 3, 1864. In his early days he was connected with the Pennsylvania, New York, New Haven & Hartford and West Shore railroads. Afterward he was with the Staten Island Rapid Transit Company, later associating himself with the Metropolitan Street Railway Company of New York City. After this he became superintendent of the Forty-second Street and Manhattanville Railroad. He held this position at the time the street railways of New York City abandoned the cable-car system and adopted electric traction. From New York Mr. Dill went to Ypsilanti, Mich., as general manager of the traction company, and later held like positions in Kalamazoo, Mich., and Youngstown, Ohio. It was in 1908 that he became associated with the Susquehanna Railway, Light & Power Company, when he was appointed general manager of the Elmira Water, Light & Railroad Company, one of its subsidiaries. Two years later he became vice-president and general manager of this property. From Elmira he was transferred to New York as assistant to the president of the Susquehanna Railway, Light & Power Company, upon the reorganization of which he was made vice-president of the United Gas & Electric Corporation and also held the office of vice-president and director of many of its subsidiary companies. Early in 1915 he went to New Orleans to assume charge of the work of the company in the South, returning a year later to New York. At the time of his death he held the position of vice-president of the United Gas & Electric Engineering Corporation, and during the past year he devoted all of his time and energy to the oil developments in the Oklahoma field. There have been few men in the gas, electric and street railway fields who have had a wider circle of friends and acquaintances than did Mr. Dill, in large part because of the great geniality and approachability that were among his prominent traits and endeared him to those who knew him in the different parts of the country where he had lived.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

AGENCY SYSTEM EXTENDED TO CENTRAL STATIONS ON LAMPS

Manufacturers Recognize Utilities as Distributers—Arrangement Will Not Interfere with Free-Renewal Policy

Central lighting stations which through many years have supplied lamps to customers on their circuits in conjunction with the supply of energy have in several cases been led by the attitude of public service commissions to separate their transactions in lamps from their sale of energy. At the same time their disposition to co-operate with local electrical dealers and their desire to maintain a high standard of lighting on their circuits have maintained their interest in the actual distribution of lamps to their energy customers. This condition has led to the entry of central lighting stations into the merchandising field, and the manufacturers of incandescent lamps have recognized the exceptional value of the central lighting station as a distributing medium and have arranged to extend their agency system to include such central stations as are found in this situation. The arrangement contemplates the continuance of the free-renewal policy where desired by the central station.

Therefore, it is the opinion of the manufacturers that central lighting stations may hereafter be engaged in the merchandising of lamps for the manufacturer without neglecting or impairing the technical service of their customers which they have rendered in the past in the matter of maintaining high standards of illumination. By this arrangement the manufacturers believe the interests of both the central station and the consumer will be well conserved.

POST-WAR FOREIGN TRADE COMPETITION MEASURES

German Electrical Manufacturers Laying Aside Surpluses to Be Used Probably in Keeping Down Prices

Ever since the European war started in the summer of 1914 countless rumors have gone out regarding the action that was to be taken by German industries in foreign trade after the war was over. The most persistent rumor has been that German goods would be dumped upon the markets of the world in such quantities as to flood them.

This question has come up recently from another angle and is of such significance that it will bear investigation. The dye manufacturers of the world know full well the methods employed by the German dye manufacturers to secure the control of the dye industry of the world. It was a very simple thing to do and amounted to nothing more or less than putting German goods in foreign markets to be sold at a price less than it cost the domestic manufacturer to produce goods of similar quality Of course, the German manufacturers were losing money on the transaction, but they had prepared for it for a long time and had laid up a reserve to be used for just such a campaign. As a result it was not long before the German manufacturers had this market in their control, and when the war broke out the world found itself at a loss to secure sufficient materials of this character.

Recent investigations show that the German electrical manufacturers have undoubtedly something of the same kind in mind for foreign trade competition after the war is over. It is now definitely known that certain of the more important German electrical manufacturers have since the war began been accumulating large surpluses designated as reserves to be used in after-the-war commerce. Therefore, in view of the past performances of German manufacturers, it is not difficult to read between the lines and understand what German electrical manufacturers have in mind to do as soon as the war is over.

Right now American and English manufacturers are enjoying practically the entire foreign trade of the world in electrical goods, but their prices are high, particularly those of American-made goods. The American foreign trade in electrical goods has virtually doubled since the war began. In order to retain this trade after the war, German competition will have to be met, and if the above indications are finally borne out, then it becomes evident that American manufacturers must employ some similar measures in order to protect their interests in foreign trade as soon as the war is over. American manufacturers are now enjoying a larger business than ever before and are in a position, generally speaking, to lay aside sufficient reserve for just such a contingency.

FOREIGN INCANDESCENT LAMP PRICES ADVANCE

Supremacy of American Lamps in the World's Market Now Seems Assured on Both Quality and Price Basis

Advices received from abroad are to the effect that the principal German lamp manufacturers, including the Allgemeine Electricitäts Gesellschaft, Siemens-Schuckert, Auer company, Bergmann company and Julius Pintsch, have further increased the price of metal-filament incandescent lamps as of May 1. The increase averages 20 per cent. It is also known that Holland manufacturers had definitely decided to increase prices a few months ago. No information could be had relative to an English advance in lamp prices, and the opinion was expressed that since English prices have always been high in all probability the margin of profit has been sufficient not to warrant any increase.

American incandescent lamps, as is well known, have not been increased in price. Although production costs for labor and material have increased, considerable economies of manufacture have been effected so that manufacturers have been enabled to keep costs down sufficiently to be able to continue taking orders at the same low prices.

The higher prices for foreign-made lamps appear to be significant in connection with foreign trade. Germany, of course, now has but little foreign trade. Some German lamps are being shipped to Scandinavian countries and to German allies, and a considerable quantity are said to find their way into Russia. German lamps, it will be remembered, were used almost entirely in Russia prior to the war, and furthermore the sockets used for the most part in Russia are of a design to fit German lamps only. Consequently there is a demand there for German lamps, although the Russian government has imposed a high import tax on them.

England, so far as can be learned, is exporting no incandescent lamps to speak of, and Holland is shipping large quantities of lamps to England and is attempting to cultivate the Scandinavian and Russian markets to the exclusion of some of the other markets at a much greater distance.

Because Germany has been bereft of almost all of her export business the volume of lamp production has fallen somewhat, but in view of the increased domestic market it is doubtful if the decrease in production has been very great. Other foreign manufacturers have been operating under

maximum production conditions. Therefore it is not unfair to assume that prior to the war the lamp prices of foreign manufacturers, except the English, were as low as could be. Furthermore, the price increases would indicate that economies of production had not been effected abroad to the same extent that they have in the United States.

Consequently it seems reasonable to suppose that after prices of labor and material return to lower levels American incandescent lamps will be able to compete in the world markets, not only on a quality basis as formerly, but on a price basis as well. In fact, it will be strange if American lamps do not undersell all foreign-made lamps of anywhere near the same quality.

Exports of American standard incandescent lamps are now running at the rate of 9,000,000 to 10,000,000 lamps a year, in comparison with about 2,000,000 lamps two years ago. Foreign inquiries for American lamps are very large, and right now there are foreign buyers who would place orders for millions of lamps if they could be produced.

American supremacy in the world incandescent-lamp market seems assured. American producers have so perfected their manufacturing processes that there now seems no doubt that better incandescent lamps can be manufactured in the United States at a smaller cost than anywhere else in the world.

ADEQUATE RESERVES HELD AGAINST LOWER PRICES

Average of 33 1/3 Per Cent of Profits Made on Advancing Market Thought to Be Sufficient to Protect Jobbers

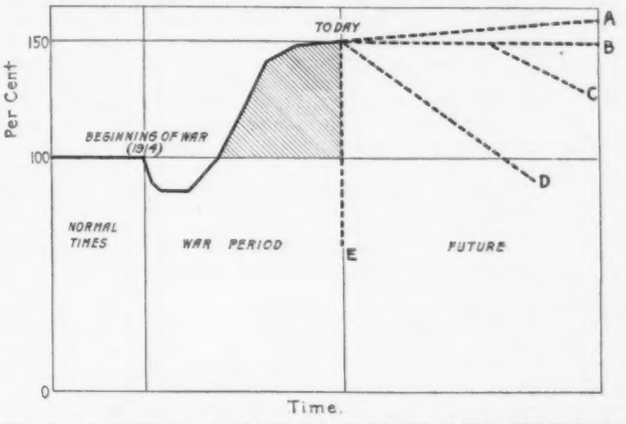
That whatever goes up must come down is axiomatic. The prices of electrical goods have soared within the last two years, and while as yet the peak may not be reached, although it is not thought that prices will go much higher, eventually, when conditions generally return to normal and the nations of the world are again at peace and engaged in a commercial struggle, lower prices will result. While it may be true that the low levels of the period immediately preceding the war will not again become general, it is certain that the prices of that day will be lower than to-day's.

It is just this certainty that prices will eventually become lower that is disturbing the electrical supply jobbing trade to-day. There is no doubt in the jobber's mind that when prices begin to tumble he will lose money directly as the rate at which prices begin to fall and also according to the volume of stock he is carrying. As was shown in the ELECTRICAL WORLD for June 2 and June 9, the supply jobbers of the East—and these figures certainly will be no lower for any other section of the country—have had to lay in an excess stock of 40 per cent in volume, owing to the present conditions of delivery, and the entire investment in stock is now, roughly speaking, 120 per cent greater than under normal conditions, while the increase in the price of goods on the average has amounted to around 50 per cent.

Jobbers generally agree that something must be done to take care of this loss, which will eventually occur, and it is pretty certain that all of the progressive jobbers at least have laid by a reserve fund to meet this contingency or will do so.

During all that period in which prices were advancing rapidly jobbers had an opportunity, by selling at the market, to make large excess profits. They bought the goods when they were low and had an opportunity to sell them after an advance had gone into effect. Of course, it is known that a good many jobbers hesitated to raise their prices until the prices had been raised on them; in fact, some are still hesitating. Goods they bought at the low market they continued to sell at the low market until it was necessary to buy further supplies. For the customer of course this was excellent, but it is certainly extremely doubtful if when prices begin to come down he will show the same courtesy to the jobber and pay high prices for high-priced stock when the market is lower.

The size of the reserve that shall be laid by to take care of the loss resulting from a weakening market depends of course upon individual conditions. Those who are carrying small stock and operating on the principle of very rapid turnover will, of course, not have an occasion to set aside so large a reserve as those carrying larger stock with less rapid turnover. Besides, the character of the stocks will influence the reserve to a certain extent. It is believed, however, by those who have been asked to express an opinion that on the whole a reserve of 33⅓ per cent of the profits during the period in which prices were increasing—the shaded area in the accompanying graph—would, in the



TREND OF PRICES OF ELECTRICAL SUPPLIES WITH RESPECT TO PRICES IN EFFECT AT OUTBREAK OF WAR IN EUROPE

Future prices may follow along *A*, but probably only for a short time. Doubtful if market will drop off suddenly as *E* or even as quickly as *D*. Also doubtful if peak condition will continue indefinitely as *B*. More probable course of market prices is such as is suggested by *C*, namely a continuation of peak conditions for a time and then a more or less gradual falling off.

average case, be an ample reserve to set aside to take care of the losses that will have to be met through a decrease in prices. This is an average figure and anticipates that the drop will be neither too sudden nor too slow. If the drop is very sudden—such as *E* in the graph—in other words, if the bottom absolutely falls out of the market—then, of course, such a reserve would not be adequate; while on the other hand, if the market trails off very, very slowly, as *C* in the graph, and good business conditions can be expected for two or three years after the close of the war, then, of course, the 33⅓ per cent will prove to be more than adequate.

METAL MARKETS CONDITIONS

Copper Is Somewhat Easier, While Other Metals Are Generally on a Firm Basis

Definite action on the part of the government regarding what course it purposes to pursue with regard to its future purchases of metals is having its effect on the metal markets. Copper, which it is expected will be purchased by the government at about 5 cents under the present market, is gradually easing down. Lead, however, is doing just the reverse.

Nominal quotations on electrolytic copper on Tuesday were as follows in New York: June, 32.62½ cents; July, 31.62½ cents; third quarter, 31 cents; fourth quarter, 29.25 cents.

NEW YORK METAL MARKET PRICES

	June 11 Selling Prices Bid	Asked	June 18 Selling Prices Bid	Asked
Copper:	£ s d		£ s d	
London, standard spot	130 0 0		130 0 0	
Prime Lake	31.00 to 32.00†		31.00	to 32.00†
Electrolytic	32.50 to 33.00†		32.50	to 32.75†
Casting	30.00 to 31.00†		30.00	to 31.00†
Copper wire base	37.00 to 38.00†		37.00	to 38.00†
Lead	11.00		11.00	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	19.00		19.00	
Spelter, spot	9.55 to 9.67½		9.42½	to 9.55
Tin, Straits	60.75†		63.00†	
Aluminum, 98 to 99 per cent	56.00 to 58.00†		56.00	to 58.00†
OLD METALS				
Heavy copper and wire	28.00 to 28.50		27.75	to 28.25
Brass, heavy	17.50 to 18.00		17.50	to 18.00
Brass, light	14.50 to 14.75		14.50	to 14.75
Lead, heavy	10.00 to 10.25		10.00	to 10.25
Zinc, scrap	7.25 to 7.50		7.00	to 7.25

†Nominal.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard package or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists to contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List, per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

No. 14 solid:	
Less than coil	+10% to $54.90 Net
Coil to 1000 ft.	3% to 48.80 Net
No. 12 solid:	
Less than coil	+10% to 63.90 Net
Coil to 1000 ft.	3% to 56.80 Net

Twin-Conductor

No. 14 solid:	
Less than coil	+10% to $78.00 Net
Coil to 1000 ft.	3% to 75.00 Net
No. 12 solid:	
Less than coil	+10% to 121.00 Net
Coil to 1000 ft.	3% to 108.00 Net

CHICAGO

Single-Conductor

	Net Price
No. 14 solid:	
Less than coil	$51.85 to $67.10
Coil to 1000 ft.	48.80 to 54.90
No. 12 solid:	
Less than coil	60.35 to 78.10
Coil to 1000 ft.	56.80 to 63.90

Twin-Conductor

No. 14 solid:	
Less than coil	$85.00 to $114.40
Coil to 1000 ft.	77.50 to 93.60
No. 12 solid:	
Less than coil	114.75 to 148.50
Coil to 1000 ft.	108.00 to 121.50

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+20% to 12%
1/5 to std. pkg.	10% to 20%
Std. pkg.	24% to 34%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to 12%
1/5 to std. pkg.	Net to 20%
Std. pkg.	34% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.35	$0.35
12 to 50	.30	.30
50 to barrel	.28	.28 to .29
Barrel lots	.24	.25

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.35	$0.35
12 to 30	.30	.30
50 to barrel	.26¼	.27¼ to .29
Barrel lots	.24¾	.25¾

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
5/16	250	$5.00
⅜	250	7.50
½	100	10.00
¾	50	13.00
1	50	21.00
1¼	50	26.00
1½	25-50	35.00
2	25-50	45.00
2½	25-50	52.00

DISCOUNT—NEW YORK

	Less than Coil	Coil to 1000 Ft.
⅜-in. single strip	.....	.....
⅜-in. double strip	.....	.....
½-in. single strip	Net to 10%	7% to 20%
½-in. double strip	Net to 5%	4% to 15%

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
⅜-in. single strip	$71.25 to $75.00	$60.00 to $63.75
⅜-in. double strip	67.50 to 71.25	75.00 to 78.75
½-in. single strip	95.00 to 100.00	80.00 to 85.00
½-in. double strip	100.00 to 105.00	90.00 to 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, in.	List, per Foot	Size, in.	List, per Foot
7/32	$0.05½	1	$0.25
¼	.06	1¼	.33
⅜	.09	1½	.40
½	.12	1¾	.47
⅝	.15	2	.55
¾	.18	2¼	.65

DISCOUNT—NEW YORK

Less Than $15 List	$15 to 60 List	$60 to $150 List
Net to 33⅓%	45% to 50%	53% to 55%

NET PER 1000 FT.—CHICAGO

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.	$36.67	$37.50	$24.75
¼-in.	40.00	30.00	27.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 38

Size, in.	Conduit, List per Foot	Couplings, List	Elbows, List
¼	$0.08½	$0.05	$0.19
⅜	.08½	.06	.19
½	.08½	.07	.19
¾	.11½	.10	.25
1	.17	.13	.37
1¼	.23	.17	.45
1½	.27½	.21	.60
2	.37	28	1.10
2½	.58½	.40	1.80
3	.76½	.60	4.80

DISCOUNT—NEW YORK

	¼ In. to ½ In.	¾ In. to 3 In.
Less than 2500 lb.	6% to 8%	8% to 10%
2500 to 5000 lb.	9% to 11%	11% to 13%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ In. to ½ In.	¾ In. to 3 In.
Less than 2500 lb.	3.8% to 7.8%	5.8% to 9.8%
2500 to 5000 lb	6.8% to 10.8%	8.8% to 12.8%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

Net ..... $3.15 to $3.50

CHICAGO

Net ..... $3.10 to $3.85

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	28%
1/5 to std. pkg.	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	28%
1/5 to std. pkg.	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$5.75 to $6.30
1/5 to std. pkg	4.50 to 5.25

Standard package, 500. List, $0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$6.25
1/5 to std. pkg	5.25

Standard package, 500. List, $0.07.

LAMPS, MAZDA

105 to 125 Volts

Regular, clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0.27
60-watt—B	100	.36
100-watt—B	24	.65
75-watt—C	50	.65
100-watt—C	24	1.00
200-watt—C	24	2.00
300-watt—C	24	3.00
Round bulbs, 3½ in., frosted:		
15-watt—G 25	50	.50
25-watt—G 25	50	.50
40-watt—G 25	50	.50
Round bulbs, 3¾ in., frosted:		
60-watt—G 30	24	.72
Round bulbs, 4¾ in., frosted:		
100-watt—G 35	24	1.05

105 to 125 Volts

DISCOUNT—NEW YORK

Less than std. pkg	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg	Net list
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30.00 to $35.17
Coil to 1000 ft.	21.00 to 26.73

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$37.20 to $38.16
Coil to 1000 ft.	27.90 to 28.62

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100	$18.00 to $29.00

CHICAGO

Net per 100	$20.00 to $28.35

OUTLET BOXES

Nos.	List, per 100
101—A, A1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200 S.E., 300, A.X. 1½, 4 S.	30.00
103—C.A., 9, 4 R., B 1½	25.00
106—F.A., 7, C.S. 1½, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	List to 33%	List to 27%
$10.00 to $50.00 list	42%	18% to 37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	40%	35%
$10.00 to $50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg	$14.00 to $20.00
1/5 to std. pkg	13.00 to 15.80

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg	$14.00
1/5 to std. pkg	13.00

Standard package, 2200. List per 1000, $20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	5½ N.C.—Solid Std. Pkg. 3500	Nail-It—N.C. Std. Pkg. 4000
Less than 1/5 std. pkg	$10.50 to $24.30	$21.10
1/5 to std. pkg	9.75 to 12.15	28.00

CHICAGO

Per 1000 Net	5½ N.C.—Solid Std. Pkg. 3500	Nail-it—N.C. Std. Pkg. 4000
Less than 1/5 std. pkg.	$8.40 to $10.50	$28.00
1/5 to std. pkg.	7.80 to 9.75	21.50

SOCKETS AND RECEPTACLES

	Std. Pk.	List
⅛-in. cap key and push sockets	500	$0.33
⅛-in. cap keyless socket	500	.30
⅛-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	Net
1/5 to std. pkg	15 to 20%

DISCOUNT—CHICAGO

Less than 1/5 std. pg.	Net list
1/5 to std. pkg	15%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

Perkins or Trumbull Type A:	List
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Perkins Type or Trumbull Type C:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp, 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

Less than $10 list	
$10 to $25 list	11% to 16%
$25 to $50 list	14% to 24%

DISCOUNT—CHICAGO

Less than $10 list	+5%
$10 to $25 list	11% to 16%
$25 to $50 list	14% to 24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp., three-point	100	.56
10-amp., three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10%
1/5 to std. pkg	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg:	List + 20% to net list
1/5 to std. pkg	Net list to 15%
Std. pkg.	30%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar	List, Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	Net to 23%	Net to 18%
$2.00 to $10.00 list	23% to 50%	18% to 40%
$10.00 to $50.00 list	23% to 60%	18% to 52%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $2.00 list	25% to 50%	20% to 40%
$2.00 to $10.00 list	25% to 50%	20% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

Net price	$2.10 to $3.50

CHICAGO

Net price	$2.80 to $3.50

WIRE, ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.52 to $0.62
No. 18, full spools	0.48 to 0.53

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.565 to $0.6885
No. 18, full spools	0.495 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net—		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$15.00-18.00	$12.00-14.50	$11.50-12.50
12	21.06-27.05	18.96-22.85	18.01-20.95
10	29.60-39.27	26.64-33.66	24.68-25.31
8	42.40-51.44	38.16-48.42	33.51-36.25
6	72.19-89.57	64.98-76.80	56.63-61.73

CHICAGO

	Price per 1000 Ft. Net—		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$18.00	$16.00	$14.00
12	25.92-29.89	21.96-25.62	19.44-23.48
10	36.48-42.28	30.84-36.24	27.36-33.22
8	43.80-52.24	40.15-47.25	39.18-47.25
6	69.24-88.72	63.47-77.63	56.55-66.54

WIRE, WEATHER-PROOF

Solid-Conductor, Triple-Braid, Sizes 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$40.25 to $45.00
25 to 50 lb	39.25 to 42.00
50 to 100 lb	38.00 to 38.25

CHICAGO

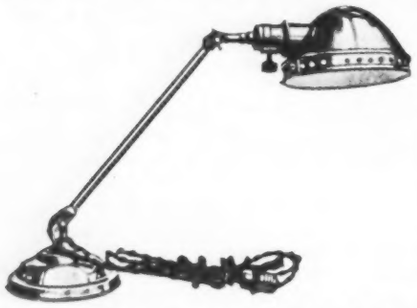
	Per 100 Lb. Net
Less than 25 lb.	$40.35 to $45.50
25 to 50 lb.	41.35 to 44.50
50 to 100 lb.	40.35 to 43.50

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Light Diffuser

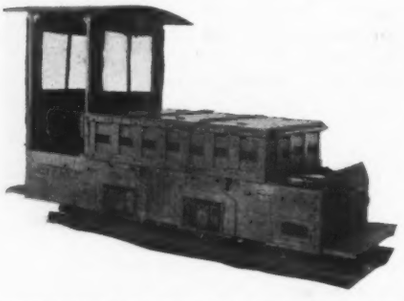
The F. H. Trimble Manufacturing Company of Los Angeles, Cal., has developed the light diffuser shown in the accompanying illustration. This device throws a soft light, doing away with all glare. It is made in different sizes, and can be attached to any metal shade. The metal part is brushed-brass finish, and the glass is sanded.



DIFFUSER THAT FITS ANY METAL SHADE

An Industrial Electric Locomotive

An industrial electric locomotive, which is provided with a canopy for the trip-rider and which has a single-charge rating of 240 ton-miles (3.46 t.-km.) on the level, is being manufactured by the Jeffrey Manufacturing Company of Columbus, Ohio. The battery consists of 63 A-10 Edison cells, having a rated output of 28 kw.-hr. If the battery is boosted at the normal rate for one hour in the middle of the ship, it is claimed that it will handle 300 ton-miles (4.33 t.-km.). Totally inclosed double-reduction type motors are used, each having a rating of 160 amp. for one hour. The journal box is of special construction to take inthrust of the wheels and axles. A steel pin in the end of the axle bears against a plate in the head of the journal box, thus eliminating the wear between the wheel hubs and the journal boxes.



LOCOMOTIVE ADAPTED TO OPERATION DURING LOW TEMPERATURES

The Jeffrey company is also making a truck equipped with a single motor with chain drive between axles, and a battery of 63 A-4 Edison cells, or 48 M.V. 9 Ironclad Exide cells. One of the features of this truck is the lack of projecting parts. The headlight is set in the end frame and is provided with a very thick lens. This position minimizes the chance of damage and provides good light on the track ahead of the operator. Protection to the operator is afforded by the arrangement of the driving end of the truck. The weight of the truck complete is 2.5 tons (2.25 t.). It is claimed that on the average a performance of 100 ton-miles (144 t.-km.) is obtained with a single charge of the battery.

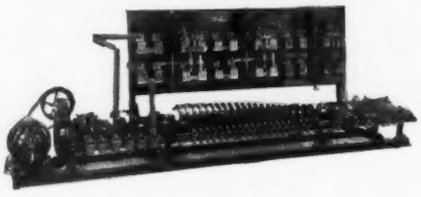
Projector Using a Gas-Filled Lamp

A projector for use in protective floodlighting and designed to use a gas-filled tungsten lamp is being manufactured and marketed by the Luminous Unit Company of St. Louis, Mo. A simple focusing arrangement is provided by means of which it is possible to adjust the light ray from a narrow searchlight beam to a wide flood of light, as conditions may require. By means of an external control it is possible to make this adjustment quickly. Two sizes are available, ranging in capacity from 200 to 500 watts. The large size is arranged for mounting on ¾-in. (19-mm.) pipe, while the small style is designed for ½-in. (12.7-mm.) pipe.

FLOODLIGHTING PROJECTOR WITH ADJUSTABLE-DISPERSION BEAM

Remote-Control Switch for Sign Flasher

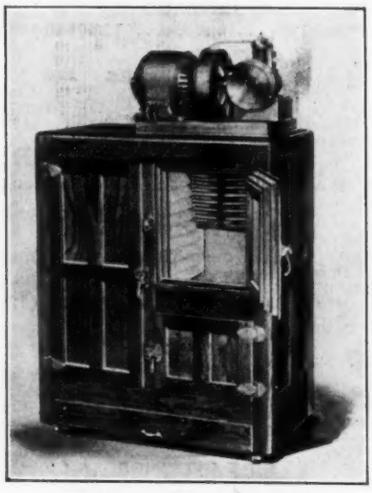
A remote-control switch for use with electric sign flashers is being manufactured by the Betts & Betts Corporation, 511-513 West Forty-second Street, New York City. One of the advantages claimed for this switch by the manufacturers is that it is impossible to burn out the magnet or center of the switch. One magnet is used for opening the circuit and one for closing. The contacts are interchangeable and secured by one screw, making it easy to introduce changes in the flashing order and to install new sectors.



MAGNETIC SWITCHES ON FLASHERS

Household Refrigerator

Motor-driven refrigerating apparatus that can be placed on top of an ordinary ice box is being manufactured by the National Self-Cooling Machine Company of Youngstown, Ohio. It consists essentially of a motor driving a compressor and a fan. These units are arranged with unusual compactness. As the pump draws the refrigerating fluid from the refrigerator into the radiating coil the fan blows air away from the coil and over the compressor. Thus the fan does double duty. A pressure regulator or

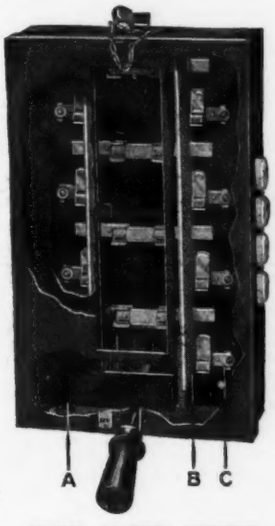


DOMESTIC REFRIGERATING SET

controller breaks up the fluid into a fine gas as it enters the expansion chamber or cooling coils. A thermostat regulates the temperature of the refrigerator and is ordinarily set at 38 deg. or 40 deg. Fahr. (3.3 deg. or 4.4 deg. C.). It controls the motor, which under usual conditions runs from three to six minutes in every hour. The pressure to which the fluid is compressed is about 60 lb. (4.2 kg. per square cm.), but the machine has a factor of safety of about seven. An ice-making attachment that will make enough ice for the general requirements of the household is supplied with the device. The refrigerating fluid is not inflammable and will not support combustion. Furthermore it is not poisonous to inhale. The manufacturer points out that the refrigerating unit contains no chains or belts and that practically all moving parts operate in oil.

Safety Switches

Fused switches the current-carrying parts of which are inclosed in cabinets which prevent access thereto when operating the switch or re-fusing the cut-outs have been developed by the Palmer Electric & Manufacturing Company, 62 K Street, Boston, Mass. From the accompanying illustration, which shows sections of the different parts of one switch, it may be seen that the switch blades are carried by a panel which also supports the fuses, the panel being moved up or down by a handle protruding through the cover, thus opening or closing the switch. When the contacts are closed the current-carrying parts of the fuses and the knife blades are covered by a shutter in the front of the cabinet. This shutter cannot be opened to expose the fuses except by opening the switch, in which position it is held until the shutter is again closed. Barriers on each side of the



FUSED SAFETY SWITCH

panel opening prevent access to the "live" parts when the contacts are open. With this construction it is obvious that when the switch is open the fuse terminals must be "dead," as the shutter positively interlocks with the switch handle. When the fuses are exposed the barriers at each side of the panel opening effectively prevent access to any energized part.

Temperature Indicators for Electrical Apparatus

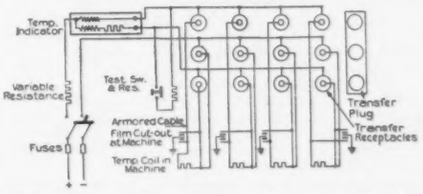
Temperature indicators have been developed by the General Electric Company of Schenectady, N. Y., which when used in conjunction with temperature coils in electrical apparatus afford a convenient and rapid means of indicating continuously at the switchboard the temperature of various portions of the windings of electrical apparatus under various conditions. The indicator is a direct-current differential indicator with three terminals. Its operation depends on the variation of resistance of a copper resistor placed in a slot of the machine stator in contact with the insulation of the winding, or in any loca-

TEMPERATURE INDICATOR MOUNTED ON SWITCHBOARD

tion external or internal where the resistor may be protected from the conductors by suitable insulation. Four temperature coils are used on machines rated at 500 kva. to 3125 kva., two of the coils being considered as spares. Above 3125 kva. six coils are used, three of which are spares.

One of the windings of the temperature indicator is in series with a coil of manganin, having a resistance equal to that of the temperature coils (usually at 80 deg. C.) The other winding is in series with the temperature coil itself. When the temperature in the upper coil rises, the current in the branch of the circuit including the temperature coil decreases, causing a corresponding deflection toward the higher temperature end on the indicator scale. The reverse action occurs when the temperature of the temperature coil falls. The scale of the standard instrument has a range of 20-120 deg. Fahr., or 0-90 deg. C., marked in 1-deg. divisions.

The temperature coils are made of copper wire wound in a thin form and pressed flat so as to be non-inductive. Terminal boxes are provided for attaching to each machine. Above each terminal box is a protective device which protects the operators and the apparatus in case a coil becomes grounded to the power winding. The protective



WIRING PLAN OF TEMPERATURE INDICATOR

equipment consists of six pairs of film-disk cut-outs supported by spring clips with a grounding connection between them, the spring clips being connected to the terminals of the coil. Abnormal pressure between the temperature coil and ground breaks down the corresponding film and thus brings that particular circuit to ground potential.

To permit compensating for variations in the voltage of the supply circuit a variable resistance with a dial switch and index is furnished. A single-pole, single-throw pole button test switch is provided on the indicator board to connect the resistance in muliple with any of the temperature coils. If the outfit is in proper working order when this is done, the indicator will show a reduction in reading.

Special three-point receptacles and plugs are used to permit transferring the connections of the temperature indicator to any of the coils in the machine winding. The center point of each plug is made shorter than the other two, so that the circuit is broken before the instrument is disconnected from the coil.

Soldering Iron

A copper-pointed soldering iron which is heated by the contact resistance, with two carbon electrodes, or more specifically by the white heat produced at the electrode tips, is being manufactured by the Clemens Electrical Corporation of Buffalo, N. Y. The copper point is brought in contact with the electrodes by releasing a catch on the spring. The iron may be heated ready for use in less than two minutes, it is claimed. The outfit is designed for tinning, running of seams and soldering of low-fusing metals such as zinc

ELECTRODE-HEATED SOLDERING IRON

and lead. Two sizes are put out, one requiring 60 watts and the other 150 watts. Any special pointed copper can be attached to this soldering iron. To heat these irons only 5 to 7 volts is used, transformers being provided to give this low voltage.

Trade Notes

THE FRANKEL CONNECTOR COMPANY, INC., has moved its salesrooms to 1140-1146 Broadway, New York City.

THE ROSS POWER & EQUIPMENT COMPANY has been appointed Indianapolis representative of the Lincoln Electric Company, with offices at 617 Merchants' Bank Building, Indianapolis.

THE NEW-WAY MOTOR COMPANY, Lansing, Mich., has added to the list of service stations the following: Hubbard & Floyd, New York City; T. T. Burchfield, Philadelphia; Frank & Allan, Chicago.

CHRISTIAN E. BROWN, for a number of years with the Western Electric Company and later at the Edison Laboratory, is now chief engineer for the American X-Ray Equipment Company and the General Optical Company, and will specialize in the development of X-ray, high-frequency and scientific apparatus.

THE PACKARD ELECTRIC COMPANY, Warren, Ohio, at a recent meeting of directors, named the following officers for the coming year: President, N. A. Wolcott; vice-president, Charles Fillius; secretary, R. E. Gorton; treasurer, N. A. Wolcott. Mr. Wolcott, the new president, has been associated with the Packard organization in the position of treasurer for the last fourteen years. No immediate change in the company's policy is contemplated by the new officers.

FRANCIS C. SHENEHON, for the last eight years dean of the College of Engineering of the University of Minnesota and head professor of civil engineering, has opened offices in the New Metropolitan Bank Building, Minneapolis, and will give his entire attention to his practice as a consulting hydraulic engineer. Mr. Shenehon will specialize in water power, water supply, sewerage and sewage disposal, river improvements, docks and terminals, flood control and drainage. He will also give attention to settlement of engineering controversies and act as counsel in litigation involving engineering matters.

THE PACKARD ELECTRIC COMPANY, Warren, Ohio, has purchased a group life insurance contract which insures the life of every employee for the amount of one year's salary. The insurance increases with salary increases and also provides an increase of $100 for each year of service after Dec. 1, 1916, with a maximum increase of $500. The premiums are paid wholly by the company and have no bearing whatever on any of the welfare activities of the employees themselves. The benefits derived from this insurance feature are in addition to those provided for by the Ohio compensation law. In addition to the distribution of the insurance policies those employees who have been with the company for five years or more received bonuses, the size of the bonus being governed by the number of years each recipient had been connected with the company.

WESTINGHOUSE COMPANY ERECTS BUILDING FOR BACHELOR EMPLOYEES.—In connection with the working out of plans to better in every way possible the working and living conditions surrounding its employees the Westinghouse Electric & Manufacturing Company has just completed the erection of a building at East Pittsburgh for housing bachelor workmen. This building, which has been christened Hill Lodge, is two stories high in front and three in the rear and is designed to accommodate 130 men besides the steward and his assistants. All the rooms except six will accommodate four men, and each is equipped with a single bed for each man, a table and chairs. The other rooms are equipped for two men each. Bedding and towels are furnished by the company. Kitchen, pantry, storeroom and dining room large enough to seat all the boarders at one time are in the basement. Adjacent to the dining room are compartments in which each man may place his dinner pail, so that it may be cleaned and left ready for the next morning. Breakfast and dinner are served every day, and the mid-day meal on Saturdays and Sundays, in the dining room. On the other days lunches are taken out in the dinner pails. In the basement are also the living quarters of the superintendent and his assistants. The entrance room, office, lavatories and shower baths are on the first floor. The building is steam-heated and fire protection is afforded. Four large porches provide ample space for the men to gather to enjoy the outdoor air. Employees are assigned to the lodge by the employment department of the company upon request. A nominal weekly charge is made for the accommodations furnished.

LAWFORD GRANT has been appointed managing director and treasurer of the Eugene F. Phillips Electrical Works, Ltd., Montreal.

A. PRESS, consulting engineer and patent attorney, has changed his address from Norman, Okla., to 1777 Broadway, New York City.

THE EDISON LIBERTY LOAN CLUB, formed of employees of Thomas A. Edison, Inc., and affiliated companies, Orange, N. J., has oversubscribed its pledge of $300,000 by $500,000, making a total subscription of $800,000, or almost $100 for every employee connected with the Edison interests.

STRACHAN, OSWELL & COMPANY, LTD., of 6 Broad Street Place, London, E. C., have formed a subsidiary company under the title of Strachan, Oswell & Jepson, Inc., with offices at 32 Broadway, New York City, following the precedent established by several British export houses that have opened big branches in New York City. Strachan, Oswell & Company, Ltd., have been established in London for nearly twenty years, trading with South Africa, Mauritius, the Strait Settlements and China, in which countries they have extensive organizations. The New York branch will work on the same lines as the London house, both as buying agent for firms abroad and as selling agent for American manufacturers. It handles machinery and electrical supplies and conducts a general export commission business.

Trade Publications

ANCHORS.—The W. M. Matthews & Brother Company of St. Louis, Mo., is distributing a folder descriptive of its "Scrulix" anchors.

MOTORS.—The Universal Motor Company, Oshkosh, Wis., is distributing a mailer descriptive of its Universal 4-kw. generator set.

GRINDERS.—The Stow Manufacturing Company of Binghamton, N. Y., is distributing a folder descriptive of its grinders and portable tools.

STOVES.—The Allmur Manufacturing Company, Marion, Ind., has prepared a leaflet descriptive of its Allmur automatic electric cook stove.

REDMANOL.—The Redmanol Chemical Products Company, 636 West Twenty-second Street, Chicago, has prepared a bulletin descriptive of its Redmanol molding compounds, impregnating liquids and transparent Redmanol.

EXPANSION JOINTS.—The Ross Heater & Manufacturing Company, Inc., of Buffalo, N. Y., is distributing a folder descriptive of its crosshead-guided expansion joints, for high or low pressure, high or low temperature.

GLASSWARE.—"Street-Lighting Glassware" is the title of a new bulletin recently prepared by the Gleason-Tiebout Glass Company of Brooklyn, N. Y. The bulletin presents a new departure in illustrating this type of glassware by printing it in imitation of blueprints.

LAMPS.—The Westinghouse Lamp Company of New York City has prepared a book of engineering data on incandescent lamps to supersede all data books of prior dates. This company has also prepared an incandescent-lamp data book for agents and purchasers. Price schedules of large Mazda and metallized filament lamps are also given.

ELECTRICAL EQUIPMENT.—The General Electric Company, Schenectady, N. Y., has issued bulletins on the following subjects: Electrical equipment for heating industrial ovens, individual vehicle taper charging set with automatic panel, "Tungar" rectifier, temperature indicators, aluminum lightning arresters for alternating-current circuits, ventilated commutating-pole railway motor, type G.W. 203—P, index to descriptive bulletins and sheets.

SYNCHRONOUS MOTORS.—A bulletin explaining the characteristics, the uses and the advantages of synchronous motors in comparison with induction motors has been prepared by the Electric Machinery Company, Minneapolis, Minn. It gives photographic reproductions of machines illustrating practical applications of motor drive. The subject of power factor and power-factor correction is explained in a simple and understandable way. Charts showing the operation of certain sizes of synchronous motors on systems of lagging power factor are given.

New Incorporations

THE KINGSTON (OKLA.) ICE & LIGHT COMPANY has been incorporated with a capital stock of $20,000 by J. F. Wilkins and others.

THE HOUSTON (TEX.) STORAGE BATTERY COMPANY has been incorporated with a capital stock of $2,500 by E. S. Van Dyke, M. I. Keller and C. B. Clayton.

THE CAREY ELECTRIC & MILLING COMPANY of Spring Grove, Ill., has been incorporated with a capital stock of $5,000 by Walter Carey, B. Carey and J. E. Carey, to furnish electricity for lamps and motors in Quincy.

THE SHEPHERD-RUST COMPANY of Wilkes-Barre, Pa., has been incorporated with a capital stock of $75,000 to manufacture lighting fixtures. The company works are located at 42 West Market Street, Wilkes-Barre, Pa.

HOLLOWAY, BENTZ & COMPANY of New York, N. Y., have been chartered with a capital stock of $5,000 to do a general electrical business. The incorporators are: Charles B. Bentz, Russell C. Bentz and Walter A. Van Ness.

THE WAGNER ELEVATOR COMPANY of New York, N. Y., has been incorporated by Mahnus Tornquist, Frederick Wagner and Gustave Lienhard. The company is capitalized at $3,000 and proposes to install elevators, pumps and motors.

THE HURLBURT GASOLINE ENGINE COMPANY of New York, N. Y., has been incorporated by G. P. Hurlburt, Louis M. Eiller and Herbert H. Maass. The company is capitalized at $5,000 and proposes to manufacture motors, turbine engines, etc.

THE DUGAN-FOERST ENGINEERING COMPANY, Twenty-second Street, Bayonne, N. J., has been incorporated by John J. Foerst, J. E. and John J. Dugan. The company is capitalized at $25,000 and proposes to do a general electrical engineering business.

A. SHEMEL & COMPANY of New York, N. Y., has filed articles of incorporation with a capital stock of $30,000 to deal in electrical supplies and machinery. The incorporators are: M. Zucker, M. S. Hoham and A. Shemel, 11 West 113th Street, New York, N. Y.

THE PERMALIFE STORAGE BATTERY COMPANY of Poughkeepsie, N. Y., has been incorporated with a capital stock of $1,000,000 to manufacture storage batteries and electrical machinery. The incorporators are: E. P. Sheehy, E. T. Coffin and G. Pagnani.

THE OIL FIELD WATER, LIGHT & POWER COMPANY of Cushing, Okla., has been organized with a capital stock of $250,000 for the purpose of furnishing electricity for lamps and motors in Drumright, Cushing, Yale, Stillwater and other towns in this vicinity.

THE NORTHWESTERN IOWA POWER COMPANY of Clermont, Iowa, has been incorporated with a capital stock of $750,000 for the purpose of developing a water power plant. The officers are: Christian Miller, president, and Howard C. Runyeon, secretary, both of Clermont.

THE AIR ENGINEERING COMPANY, 225 Main Avenue, Passaic, N. J., has been chartered with a capital stock of $25,000 to carry on a general electrical engineering business. The incorporators are: Edward T. Moore, Thomas Foxhall of Passaic, and John H. Thomas of Belleville, N. J.

THE NATIONAL ELECTRIC VENDING COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $500,000 to manufacture and sell automatic vending machines. The incorporators are: Leonard L. Cowan, R. Montgomery and B. F. Cowan of Chicago, Ill.

THE KANSAS LIGHT & POWER COMPANY of Augusta, Me., has filed articles of incorporation under the laws of the State of Maine with a capital stock of $100,000, to acquire, install and operate electric-light and power plants, etc. The incorporators are H. A. Carmichael of Duluth, Minn.; R. W. Ferris and L. J. Coleman of Augusta, Me.

THE CHEYENNE VALLEY LIGHT & POWER COMPANY of Valley City, N. D., has been incorporated with a capital stock of $50,000 by K. G. Schmidt of Grand Forks; R. M. Stee of Dazey and L. C. Thomas of Fargo. The company proposes to erect electric transmission lines and supply electricity in Cheyenne Valley, including Dazey, Sanborn and Rogers.

New England States

BURLINGTON, VT.—Owing to the excessive cost of coal the commissioners of the municipal electric-light plant are considering purchasing energy from the Burlington Light & Power Company to operate the municipal system.

BOSTON, MASS.—The Boston Elevated Railway Company has awarded a contract to the Union Switch & Signal Company for signal apparatus to be installed in the Dorchester subway extension of the East Boston subway. The equipment will include double impedance bond layouts, track transformers, automatic train stops, style L, three-lens light signals, etc.

CAMBRIDGE, MASS.—Steps have been taken by the residents of Riverbank Court, Technology and others to secure the extension of the ornamental lighting system from Lafayette Square to the Harvard Bridge.

CHELSEA, MASS.—The Edison Electric Illuminating Company of Boston has petitioned the Board of Aldermen for permission to lay underground conduits and cables on Crescent Avenue, between Eastern Avenue and Mill Street.

DUNSTABLE, MASS. — Arrangements are being made by the Connecticut River Valley Power Company to extend its electric transmission lines to Dunstable to establish an electrical service in the town. The Tyngsboro Electric Light Company now furnishes electricity here.

FRANKLIN, MASS.—Right of way is being secured by the Union Light & Power Company of Franklin for the erection of a high-tension transmission line from Foxboro to North Attleboro. Additional power is needed to meet the demands in North Attleboro.

MILFORD, MASS.—The Milford & Uxbridge Street Railway Company expects to place contracts for two 750-kw. rotary converters and one 300-kw. rotary converter with transformers and switchboards in the near future.

PLYMOUTH, MASS.—Preparations are being made by the Plymouth Electric Light & Power Company to establish a switching station near West Ponds, where the circuits of the company branch out to Middleboro, Chiltonville, the Cape Cod Canal and Marion. A private telephone line is to be erected from the power plant to switching station.

SHELBURNE FALLS, MASS.—The New England Power Company has petitioned the Board of Gas and Electric Light Commissioners for permission to issue $4,000,000 in additional capital stock and $3,000,000 in bonds, the proceeds to be used for extensions and improvements to its property. The company operates through western Massachusetts and southern Vermont and distributes electricity as far south as Woonsocket, R. I.

SOMERVILLE, MASS.—The installation of an ornamental lighting system on Highland Avenue, between Central and Cedar Streets, is under consideration.

WESTFIELD, MASS.—The Westfield Power Company has closed its electric generating plant and will purchase energy from the Municipal Light Department during the summer.

PROVIDENCE, R. I.—The City Council has granted the Providence Telephone Company permission to construct underground conduit extensions in Walnut and Burrill Streets.

NEW HAVEN, CONN.—Work has begun on the erection of an addition to the power house, 41 ft. by 42 ft., one story, at the local plant of the American Steel & Wire Company on Fairmount Avenue.

SEYMOUR, CONN.—The Seymour Electric Light Company has petitioned the Public Utilities Commission for permission to lease the property of the Beacon Falls Electric Company.

Middle Atlantic States

BUFFALO, N. Y.—The City Council has indorsed a bill which would create a State hydroelectric commission, similar to that of the Province of Ontario. The bill also provides for the development of power at Niagara Falls, N. Y., by the State.

CORFU, N. Y.—The residents of the village of Corfu have voted to install an electric-lighting system.

FREDONIA, N. Y.—Extensions and improvements involving an expenditure of $120,000 contemplated by the Niagara & Erie Power Company have been approved by the Public Service Commission. The work will include the extension of the Fredonia distribution system (4000 volts) to the east line of Pomfret and to Sheridan. The Angola system will be extended to the towns of Evans and Hamburg. The Gardenville substation will be equipped to furnish 22,000 volts to the street-lighting system and to the distribution system of the Depew & Lancaster Light, Power & Conduit Company. A 4000-volt distribution line will be erected from the substation on the grounds of the Atlas Crucible Steel Company to the municipal power plant of Dunkirk.

LE ROY, N. Y.—The LeRoy Electric Porcelain Company has awarded contract for four new kilns and other equipment to increase the output of its plant.

NEW YORK, N. Y.—The Interborough Rapid Transit Company will install at its Seventy-fourth Street station a new 60,000-kw. generating unit, consisting of a high-pressure and two low-pressure turbines, each coupled to a generator. The equipment will be furnished by the Westinghouse Electric & Manufacturing Company.

NEW YORK, N. Y.—Bids will be received by the Board of Water Supply, twenty-second floor, Municipal Building, New York City, until July 10, for fitting up a chemical and bacteriological laboratory, including the furnishing and installing of fixtures, piping and lighting, ventilating and drainage systems. The laboratory is located in the lower gate chamber of Ashokan reservoir in the town of Olive, Ulster County. Drawings, etc., may be obtained at the office of the secretary upon deposit of $10 for each pamphlet. Further information may be obtained at the office of the principal assistant engineer at the above address.

JERSEY CITY, N. J.—The Delaware, Lackawanna & Western Railroad Company is planning to build a new boiler plant in connection with the roundhouse and shops to be erected on Sixteenth Street. The cost of the proposed work is estimated at $50,000.

LIVINGSTON, N. J.—At an election held recently the proposal to install a street-lighting system was carried.

NEWARK, N. J.—The Board of Freeholders has approved a fund of $25,000 in addition to the recent appropriations, totaling about $165,000, for improvements and new equipment for the power plant at the Essex County Hospital at Overbrook.

ROSELAND, N. J.—Bids will be received by the committee on street lighting until July 13 for lighting the streets of the borough. The plans provide for 32 lamps. E. Oscar De Camp is borough clerk.

SOUTH RIVER, N. J.—Plans are being considered by the Borough Council and the Board of Public Works for increasing the output of the municipal electric-light plant.

TRENTON, N. J.—Work has begun on the construction of the proposed new plant of the Imperial Porcelain Works of Trenton near Neptune City. The buildings will be 130 ft. by 250 ft., and 50 ft. by 150 ft., and will be used for the manufacture of electric porcelain goods.

TRENTON, N. J.—The Delaware & Atlantic Telegraph & Telephone Company is planning to erect new trunk lines to Wrightstown, the site for the United States Army Department. A large local exchange station will be installed, equipped with about 10 switchboards and auxiliary apparatus. An electric-lighting system will be installed at the camp.

BEAVER FALLS, PA.—Plans have been submitted to the City Council by W. G. Westphal, illuminating engineer of the Duquesne Light Company of Pittsburgh, for the installation of an ornamental lighting system on Seventh Avenue.

BENTON, PA.—Application has been made to the Public Service Commission by the Benton Hydro-Electric Company for permission to issue $75,000 in bonds for improvements, etc., to its system.

ORRTANNA, PA.—The Orrtana Electric Light & Power Company has applied to the Public Service Commission for permission to issue $11,000 in capital stock, the proceeds to be used for improvements.

PHILADELPHIA, PA.—Plans are being considered by Baugh & Son Company, manufacturer of chemicals, oils, etc., for the construction of an addition to its engine plant at its works on the Morris Street wharf.

PHILADELPHIA, PA.—Contract has been awarded by the Philadelphia Electric Company to the John R. Wiggins Company of Philadelphia for the construction of an addition to its substation on Schuylkill Avenue.

PHILADELPHIA, PA.—Contract has been awarded by C. & H. Barnett, 1078 Frankford Avenue, Philadelphia, manufacturer of files, for the construction of a new boiler plant, 30 ft. by 70 ft., one story high, at their factory.

PHILADELPHIA, PA.—The Penn Chemical Company has awarded a contract to Nickson, Duggan & Company of Philadelphia, for construction of a power house, 40 ft. by 100 ft., to be erected at its new factory. The cost of the new plant is estimated at about $75,000.

PHILADELPHIA, PA.—The M. J. Roche Construction Company, Johnson Building, Cincinnati, Ohio, has been awarded the contract for the construction of an electric power plant, 100 ft. by 250 ft., at the League Island Navy Yard, Philadelphia. Also for the construction of a similar plant at Norfolk, Va.

PHILADELPHIA, PA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 25 for an electric-lighting system for the structural shop at the navy yard at Philadelphia. Drawings and specifications (No. 2415) can be obtained on application to the bureau or the commandant of the navy yard named.

PHILADELPHIA, PA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 2 for a ventilating system, including blowers, motors, plenum chambers, ventilators, air ducts and accessories, in building 17, at the United States Navy Yard, Philadelphia, Pa. Drawing and specification (No. 2424) may be obtained on application to the bureau or to the commandant of the navy yard named.

PITTSBURGH, PA.—Plans have been filed by the Duquesne Light Company for improvements to its building at Broad and Beatty Streets, to cost about $17,000.

WEST CHESTER, PA.—The Philadelphia Suburban Gas & Electric Company, it is reported, has purchased the coal yards of Isaac H. Bailey, adjoining its property in West Chester.

WILLIAMSTOWN, PA.—The Lykens Valley Light & Power Company has filed notice of an issue of $11,000 in bonds, the proceeds to be used for improvements.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 23 for construction of addition to the nautical instrument repair shop, including electrical work, at the Naval Observatory, Washington, D. C. Drawings and specification (No. 2409) can be obtained on application to the bureau.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations as follows: Puget Sound, Wash., Schedule 1250—72 spools of silk insulating tape. Various, Schedule 1223—miscellaneous seamless voice brass tubing. Brooklyn, N. Y., Schedule 1244—one motor-driven, 24-in. upright drill, one motor-driven grindstone, one motor-driven back-geared, screw-cutting tool-room lathe, one variable-speed, motor-driven milling machine. Charlestown, W. Va., Schedule 1252—eleven 36-in. by 20-ft. motor-driven, triple-geared lathes, four motor-driven, heavy-duty, 24-in. turret machines. Washington, D. C., Schedule 1242—one motor-driven milling machine. Chelsea, Mass.—Schedule 1240—one universal woodworking machine. Applications for proposal blanks should designate the schedule desired by number.

North Central States

MONROE, MICH.—At an election held recently the citizens voted to grant the Detroit Edison Company a 30-year franchise to furnish electricity in Monroe. Under the terms of the franchise the company will purchase the municipal electric plant for $83,300.

ST. JOHNS, MICH.—Investigations are being made by the Board of Public Works with a view of enlarging the municipal electric-light plant and installing new machinery, at a cost of from $30,000 to $40,000.

CINCINNATI, OHIO.—Plans are being prepared for the erection of a substation, 75 ft. by 100 ft., for the Union Gas & Electric Company. Sargent & Lundy of Chicago, Ill., are consulting engineers.

CINCINNATI, OHIO.—Plans have been completed by Stetgner & Hughes, architects, for the construction of a coal bunker

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

with a capacity of 1100 tons for the Richardson Paper Company of Lockland. The specifications call for a considerable amount of conveying machinery.

CINCINNATI, OHIO.—The Diem & Wing Paper Goods Company has awarded a contract to the M. Marcus Building Company for the construction of a combination power plant and garage building in connection with its works off the Eighth Street Viaduct. Tietig & Lee are architects.

ELMWOOD PLACE, OHIO.—The Union Gas & Electric Company of Cincinnati has awarded a contract to the Ferr Concrete Construction Company for the construction of an electrical service station at Elmwood Place. The building will be 60 ft. by 150 ft., and is one of the improvements planned by the company in connection with the building of its new generating station on the river front.

NEW PHILADELPHIA, OHIO.—The Wise-McClung Manufacturing Company, recently incorporated with a capital stock of $200,000 to manufacture electric vacuum sweepers, has taken over the foundry of the Rath Aluminum Company and is planning to erect an addition to the building. W. A. Wise is president and general manager.

NILES, OHIO.—The Ohio Steel Products Company has recently contracted with the Trumbull Public Service Company for energy to operate its local plant. The capital stock of the Ohio steel company has been increased from $70,000 to $100,000, the proceeds to be used for improvements and extensions to its local plant.

SPRINGFIELD, OHIO.—The Ohio Electric Railway Company, it is reported, contemplates extending its system from Cincinnati to Defiance.

YOUNGSTOWN, OHIO. — The steam heating plant of the Mahoning County Light Company and the Youngstown Heating Company, both of Youngstown, serving a number of large buildings with steam for heating and other purposes, has been taken over by the Mahoning & Shenango Railway & Light Company, which will give the same service next winter from one of its own plants.

HENDERSON, KY.—The City Council has adopted an ordinance providing for the installation of an ornamental street-lighting system. A resolution authorizing the construction of a new boiler room for the municipal electric-light plant was also passed.

BLOOMFIELD, IND.—The capital stock of the Indiana Power & Water Company has been increased from $200,000 to $500,000.

LAFAYETTE, IND.—The Northern Indiana Gas & Electric Company, a Geist syndicate, is considering making a new offer to the city of Lafayette for lighting the streets of the city. The present contract of the company with the city expires next year. The company, it is understood, is preparing to build a new plant to cost about $200,000. Preliminary plans are being prepared by the city to install a plant to supply electricity for street-lighting.

ROCHESTER, IND.—The City Council has decided to accept the proposal of the United Public Service Company to furnish electricity for pumping the city water. The company will also operate the pumps.

CHICAGO, ILL.—The Electric Steel Company, 3100 South Wood Street, contemplates the erection of a two-story brick addition, 66 ft. by 100 ft., to its foundry.

DIXON, ILL.—The Public Utilities Commission has authorized the Illinois Northern Utilities Company to issue $525,000 in bonds. Of the proceeds $408,325 will be used for extensions and improvements and the remainder to reimburse the company for money already spent.

GALESBURG, ILL.—Negotiations, it is reported, have been closed whereby the Galesburg Railway, Lighting & Power Company will take over the holdings of the Weinberg Brothers and subsidiary companies. Extensive improvements are contemplated involving an expenditure of $50,000 for improvements to the acquired properties. Next year the company will probably enlarge and develop the water power of Lake Lady Washington, at a cost of about $25,000, for water-power purposes. The present plans provide for an electrically driven pumping station at the lake, together with a pipe line from the lake to the McKinley power plant; also raising the dam to increase the capacity of the lake to 33,000,000 gal.

EAU CLAIRE, WIS.—Improvements, involving an expenditure of about $30,000, to its local system are contemplated by the Wisconsin Telephone Company. Placing wires underground in the business district is included in the proposed work.

MILWAUKEE, WIS.—A power house, 25 ft. by 60 ft., will be erected in connection with St. Joseph's Convent at Twenty-second and Greenfield Avenues.

MILWAUKEE, WIS.—The Chicago & Northwestern Railroad Company is building a 35-stall roundhouse and a steam-driven power plant at the Chase yards, near the south limits of Milwaukee. The cost of the work is estimated at $350,000. W. H. Finley of Chicago, Ill., is chief engineer.

NEENAH, WIS.—Preparations are being made to change the street-lighting system in Neenah. Lamps of greater candlepower will be used in the business district and smaller ones in the residence district. Electrical service is furnished by the Wisconsin Traction, Light, Heat & Power Company.

SHAWANO, WIS.—Bids will be received at the office of the city clerk of Shawano, Wis., until July 2 for an electric generating unit for the municipal electric-light plant as follows: One simple, high-pressure, non-condensing heavy-duty Corliss engine suitable for direct connection to a 250-kw., 2300-volt, three-phase, 60-cycle, revolving field, engine type generator, speed not exceeding 120 r.p.m.; exciter to be of the 125-volt, belted type, with the exciter driving pulley bolted on engine flywheel arms; switchboard to control generator, exciter and voltage regulator; three motor-driven pumps. No separate bids will be considered on generating unit. B. Royer is president.

WATERTOWN, WIS.—The Wisconsin Gas & Electric Company is erecting an electric transmission line from Okauchee to Ashippun to supply electricity in the latter place. The company will soon start work on the construction of a transmission line to extend several miles south of Fort Atkinson to furnish electrical service to farmers in that district.

BENSON, MINN.—At an election to be held June 29 the proposal to issue $30,000 in bonds for rebuilding the municipal electric-light plant will be submitted to the voters.

CYRUS, MINN.—The local electric-light plant has been purchased by the Glenwood (Minn.) Light, Heat & Power Company, which has been granted a franchise to furnish electrical service in Cyrus.

DETROIT, MINN.—Bids will be received by W. B. Carman, clerk, Detroit, until July 2 for construction of grade school building, separate bids to be submitted as follows: (a) General contract; (b) plumbing; (c) electrical work; (d) heating and ventilating; (e) temperature regulation; (f) fans, motor drives and heaters. Copies of plans and specifications may be obtained at the office of Tyrie & Chapman, architects.

DULUTH, MINN.—An ordinance appropriating $40,000 for the installation of an electrically driven pump at the Lakewood pumping station will be introduced at the next meeting of the City Council.

MONTEVIDEO, MINN.—The Northwestern Telephone Company has purchased a site in Montevideo on which it proposes to erect a telephone exchange, to cost about $35,000.

ST. PAUL, MINN.—A preliminary order has been passed by the City Council providing for extending the ornamental lighting system on West University Avenue from Rice Street to Bedford Street, a distance of about 5 miles.

CORYDON, IOWA.—A special election will be held July 2 to submit to the voters the proposal to grant the Southern Iowa Utilities Company of Mount Ayr a franchise to supply electricity in Corydon.

DEXTER, IOWA.—The proposal to grant an electric-light franchise to a private company was defeated at a special election held recently.

HAMILTON, IOWA.—The Keokuk (Iowa) Electric Company is contemplating building an electric transmission line and railway between Hamilton and Warsaw.

LORIMOR, IOWA.—The Lorimor Light & Power Company has made arrangements to secure electricity from the Creston (Iowa) Electric Light & Power Company to operate its system. The Lorimor Company will erect an electric transmission line through Thayer and Talmage, connecting with the lines of the Creston company at Afton.

MASON CITY, IOWA.—Arrangements are being made by the People's Gas & Electric Company to extend its electrical service to Kensett and Northwood.

RIVER JUNCTION, IOWA.—The Iowa City Light & Power Company has applied for a franchise to erect an electric transmission line from Iowa City to River Junction to supply electricity here.

WATERLOO, IOWA.—The Board of Railroad Commissioners of the State of Iowa has granted the Cedar Valley Electric Company of Waterloo permission to erect and operate electric transmission lines along and upon certain highways in Black Hawk County, Butler County, Grundy County, Ringgold County, Carroll, Sac and Calhoun Counties, to supply electricity for lamps, heaters and motors in various towns and communities through which its lines pass. Clarence L. Melcher of Charles City is engineer for the company.

JEFFERSON CITY, MO.—Bids will be received at the office of the State Capitol Commission, Jefferson City, until July 2 for furnishing electric lighting fixtures for the Missouri State Capitol Building. Specifications and further information may be obtained upon application to J. Kelly Pool, secretary State Capitol Commission.

JOPLIN, MO.—At an election held June 12 the proposal to issue $225,000 in bonds for the installation of a municipal electric-light plant was defeated.

KANSAS CITY, MO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 2, for resetting four boilers and furnishing and installing steam-flow meters, feed-water regulators, etc., in the United States post office and court house at Kansas City, Mo. Specifications, etc., may be obtained at the above office or at the office of the custodian, Kansas City, Mo.

ST. JOSEPH, MO.—Work will begin at once on the construction of an addition to the power house of the St. Joseph Light, Heat & Power Company at Second and St. Felix Streets, to cost about $10,000.

BISMARCK, N. D.—The McLean County Farmers' Telephone Company is contemplating the erection of about 100 miles of telephone lines at a cost of about $10,050. A. B. Buck of Ruso is interested in the company.

GARRISON, N. D.—The Garrison Coal, Light & Power Company is contemplating furnishing electricity for lamps and motors in Garrison, Max and Douglas.

OMEMEE, N. D.—The installation of an electric-lighting plant in Omemee is under consideration.

HOWARD, S. D.—Work has begun on the erection of an electric transmission line from Howard to Winfred.

BAYARD, NEB.—At an election held recently the proposal to issue $4,500 in bonds for the installation of an electric-lighting system was carried.

BEAVER CITY, NEB.—An election will soon be called to vote on the proposal to issue $10,000 in bonds, of which the proceeds of $5,000 will be used for the municipal electric-light plant and $5,000 for water-works system.

COLUMBUS, NEB. — The Columbus Light, Heat & Power Company, it is reported, will install a new ornamental street-lighting system.

LEXINGTON, NEB.—The Lexington Mill & Elevator Company, which owns and operates the local electric-light plant, has filed an application with the State Railway Commission for approval of the erection of an electric transmission line from Lexington to Cozard, a distance of 18½ miles.

LINCOLN, NEB.—Bids will be received by the Board of Regents of the University of Nebraska, care of J. S. Dales, secretary, Station A, Lincoln, until June 25 for the construction of a teachers' training building. Separate bids to be submitted on heating, ventilating and electric wiring, etc. The cost of the building is estimated at $125,000. Coolidge & Hodgden, Corn Exchange Bank Building, Chicago, Ill., are the architects.

OMAHA, NEB.—The Nebraska Power Company has taken over the plant and holdings of the Omaha Electric Light & Power Company. Extensions to the transmission lines, it is understood, will be made.

THEDFORD, NEB.—Negotiations, it is reported, have been closed for the installation of an electric power plant in Thedford.

AUGUSTA, KAN.—Bids will be received by C. W. Hawes, city clerk, until July 2 for improvements to water-works plant, separate bids to be submitted as follows: Filter equipment—one 10-ft. by 12-in. filter unit, including wash-water pump; centrifugal pumps—one 500-gal. per minute, 200-ft. head, horizontal, motor-driven centrifugal pump; general contract—building filter house addition and pump pit and laying 3600 ft. 8-in. cast-iron pipe. Black & Veatch, Interstate Building, Kansas City, Mo., are the engineers.

DOWNS, KAN.—The Solomon Valley Power Company, it is reported, has applied for permission to sell its local power plant to A. E. Fitkin & Company of Chicago, Ill. It is expected that the plant will close down and that energy will be furnished from Concordia.

GREAT BEND, KAN.—Bids will be received by the Commissioners of Barton County, Great Bend, until July 16 for construction of court house in Great Bend, including electric wiring, heating, plumbing, etc. W. E. Hulse & Company, First National Bank Building, Hutchinson, are the architects.

JUNCTION CITY, KAN.—The Union Light & Power Company is contemplating the construction of underground pits for storing coal in large quantities; also the installation of two large engines to meet the increasing demands of service from the plant.

LA CROSSE, KAN.—Bids will be received by the city of La Crosse until June 26 for construction of brick building, foundation for machinery and oil-storage tank. Hydrants, valves and pump are yet to be purchased. The total cost of the work is estimated at $50,000.

LEAVENWORTH, KAN.—Work has begun on improvements to the power plant of the Leavenworth Light, Heat & Power Company, involving an expenditure of about $100,000. The work will include the installation of new stokers, new cooling apparatus, an additional Stirling boiler, a 2000-hp. Allis-Chalmers turbine, etc.

MANHATTAN, KAN.—The electric transmission line of the Rocky Ford Milling & Power Company is being extended from Manhattan to Alma, to furnish electricity in the latter city. The company has submitted a proposal to the towns of Wamego and Marys to furnish electrical service.

McPHERSON, KAN.—The City Commissioners have awarded a contract to the Merkel Machine Company of Kansas City for the installation of new machinery at the municipal electric-light plant, at a cost of $23,268.

PRATT, KAN.—The local electric-light plant was destroyed by a tornado on June 5.

TOPEKA, KAN.—Bids will be received by the Executive Council, care of J. T. Botkin, secretary, State House, Topeka, until June 28 for repairing east wing of the State House, including flood lighting of dome, indirect lighting system for Senate Chamber and connecting rooms. C. H. Chandler is state architect.

Southern States

ATLANTA, GA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 6 for repairs to heating apparatus, elevators, etc., in the United States post office and court house at Atlanta, Ga. Specifications, etc., may be obtained at the above office or at the office of the custodian, Atlanta, Ga.

MARIETTA, GA.—The Glover Machine Works is planning to install a steel foundry and forge shop to be operated in connection with the present plant. The equipment will include electric furnace, steam hammers, sand-blast machinery, etc.

KNOXVILLE, TENN.—The City Council has authorized an issue of $100,000 in bonds for improvements to the fire apparatus and the fire-alarm and police-call systems.

ANNISTON, ALA.—The Southern Manganese Company has awarded contract for erection of an addition, 270 ft. by 60 ft., to its plant. The extension will provide space for eight electric furnaces of type and design built by the Anniston Steel Company. The initial installation will include two furnaces.

ROBERTSDALE, ALA.—The installation of an electric-light plant is reported to be under consideration by the owners of the Robertsdale feed mills. Joseph A. Baldwin is manager.

BATON ROUGE, LA.—The Yazoo & Mississippi Valley Railroad Company is planning to equip a roundhouse, machine shop, etc., at Baton Rouge, at a cost of about $150,000.

BATON ROUGE, LA.—Contract has been awarded by the Yazoo & Mississippi Valley Railroad Company for construction of railroad shops, to cost $150,000, to T. S. Leake & Company, 608 South Dearborn Street, Chicago, Ill. The work will include eight 100-ft. stall engine-house; an 85-ft. turntable pit, machine shop and power house; two boilers and space for third boiler in boiler room; standard double cinder pit with Robertson cinder conveyor, conveyors operated by air from locomotives, etc.

BINGER, OKLA.—The installation of an electric-light plant in Binger is under consideration. Robert Baker is interested in the project.

HAILEYVILLE, OKLA.—The City Council will, it is reported, consider proposals for the installation of an electric-light plant in Haileyville.

KINGSTON, OKLA.—The Kingston Ice & Light Company, recently incorporated with a capital stock of $20,000, it is reported, has taken over the Kingston Service System. George F. Biethen is president and manager.

RED FORK, OKLA.—The town of Red Fork is contemplating the construction of a water-works system, to cost about $20,000. New equipment, including a gas engine, pump, etc., will be required. W. E. Kerr is clerk.

BEAUMONT, TEX.—The City Council has called an election for July 10 to enable the voters to pass on the proposed consolidation of the Jefferson County Traction Company, the Beaumont Traction Company and the Beaumont Electric Light & Power Company, all of which are controlled by the Stone & Webster Engineering Corporation of Boston, Mass. Under the present plans the Jefferson County Traction Company, which operates an interurban railway between Beaumont and Port Arthur, a distance of 25 miles, is to take over the two local companies as well as the property of the Port Arthur Light & Power Company. If the consolidation is authorized important extensions and improvements will be made.

DEL RIO, TEX.—The capital stock of the Del Rio & Western Telephone Company has been increased from $100,000 to $200,000.

STAMFORD, TEX.—The Hydro-Electric Metallic Battery Company, recently incorporated with a capital stock of $20,000, will use the electrical process for mining and treating copper ore in its mines near here. C. L. Pittmann is interested in the company.

Pacific and Mountain States

EDMONDS, WASH.—The City Council is considering a proposal submitted by the Washington Coast Utilities Company of Arlington for lighting the streets of the city.

EVERETT, WASH.—The Everett Gas Company, it is reported, has applied to the County Commissioners for a franchise to erect and operate an electric transmission line over certain roads in Snohomish County.

PORT ANGELES, WASH.—Notice of appropriation of 4000 cu. ft. per second of waters from the Sol Duc River, and north branch of the Sol Duc, to be used for manufacturing, milling purposes and power development, and from Lake Crescent and Lyre River, has been filed by Theodore F. Rixon, engineer, of Port Angeles. Mr. Rixon, it is said, proposes to locate a power plant near the outlet of Lake Crescent and build a series of impounding and diversion dams.

TACOMA, WASH.—Plans have been prepared by Heath & Gove of Tacoma for a new power plant for the Kapowsin School.

TACOMA, WASH.—Bids will be received by H. F. Gronen, commissioner of light and water, Tacoma, until July 2 for furnishing two lighting feeder panels and appurtenances for installation at the municipal substation. Bids will also be accepted as a whole or in separate items as follows: Polished marble switchboard, switchboard material, voltage regulators, disconnecting switches, oil circuit breakers, insulated cables, fiber copper and busbar copper.

ALBANY, ORE.—The Oregon Power Company has submitted a proposal to the City Council offering to sell its water plant to the city for $250,000. This offer does not include the electric-light plant.

ASTORIA, ORE.—The Astoria Port Commission is planning to install a semi-Diesel engine and electric generating equipment to supply electricity for lamps and motors. Fuel oil will be used. The cost of the plant is estimated at about $16,000.

GRESHAM, ORE.—Preliminary plans for a municipal electric-light plant have been filed by H. J. Stocker, city engineer of Gresham, with the State Engineering Department at Salem. The present plans provide for an expenditure of about $125,000. Work will begin about Sept. 1.

MEDFORD, ORE.—The California-Oregon Power Company is contemplating extending its electric transmission line from near Glendale through Riddle to Myrtle Creek.

MYRTLE CREEK, ORE.—The City Council is considering calling an election to submit to the voters the proposal to issue $25,000 in bonds for the construction of a municipal electric power plant.

COVELO, CAL.—George Ells is installing an electric plant to supply electricity for lighting and irrigating purposes.

CROCKETT, CAL.—Within a few weeks the Great Western Power Company of San Francisco will complete its high-tension transmission line from Moraga Valley through Lafayette, Happy Valley and Briones to Crockett, to connect with its high-tension line from Antioch and Napa. Steel towers, 80 ft. high, will carry four cables.

LOS ANGELES, CAL.—The property owners and residents on Hill Street between Washington and West Jefferson Streets have formed an improvement organization for the purpose of securing an ornamental street-lighting system similar to that which is to be installed on Broadway. F. R. Feitshans is temporary president.

NOVATO, CAL.—The Public Service Commission has approved the sale of the property of the Novato Light & Power Company, including electric, telephone and water utility properties in Novato and surrounding territory in Marin County, owned by J. W. and Albert Cain, to the Novato Utilities Company.

PORTOLA, CAL.—The United States Smelting & Mining Company has increased activities at Five Bear, Iron Dyke, Eagle Hill and other mines in the vicinity of Taylorsville and Genesee and has started aggressive developments at Native Son, Austrian Syndicate and other groups. Arrangements, it is reported, are being made by the company for the erection of a large power plant and installation of reduction equipment.

SANTA BARBARA, CAL.—Plans have been completed by the Santa Barbara Gas & Electric Company for connecting its system with the hydroelectric system of the Southern California Edison Company. The cost of the transmission line, substation and equipment is estimated at $200,000.

MURRAY, IDAHO.—The Yukon Gold Company has closed a contract with the Washington Water Power Company of Spokane, Wash., to erect an electric transmission line to Pritchard Creek dredging ground, near Murray.

SALT LAKE CITY, UTAH.—The public Service Commission has granted the Salt Lake & Utah Railroad Company permission to construct an electric railway from Granger to Magna.

SALT LAKE CITY, UTAH.—Plans have been prepared and surveys made by the War Department for the construction of a hydroelectric power plant and storage reservoir in Red Butte Canyon, to furnish electricity for lamps and motors for the army post and water supply for a division of the army.

CHLORIDE, ARIZ.—Plans have been completed by the Desert Power Company for the construction of a new transformer station, to cost about $12,000.

LIVINGSTON, MONT.—The contract for the installation of an ornamental lighting system in the business district has been awarded to the Montana Power Company, at $9,000.

Canada

VANCOUVER, B. C.—Steps have been taken by the City Council to establish a municipal electric plant to furnish electricity for lamps and motors in Vancouver. A by-law will be introduced by Mayor McBeath to provide funds for the investigation, acquiring, purchasing and developing of water-power sites.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until July 6, for elevators, galvanized steel, checkered steel plates, steel drums, engine lubricators, grease cups, etc. Blanks and information relating to this circular (No. 1150) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York City; Audubon Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until June 30 for furnishing electric cable and wire, phosphor-bronze rope, copper rod, clamp connectors, packing gaskets, belt lacing, etc. Blanks and information pertaining to this circular (No. 1149) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York City; Audubon Building, New Orleans, La., and Fort Mason, San Francisco, Cal., and also from the United States Engineer offices in the principal cities throughout the United States.

Record of Electrical Patents

Notes on United States Patents issued on June 12, 1917

1,229,211. COMBINATION LOCK AND SWITCH; Bennie L. Beckner, Anderson, Ind. App. filed Sept. 23, 1916. Adapted for use on automobiles, motorcycles, motorboats and other transportation means.

1,229,231. LAMP-LOCKING BASE; William A. Chew, Atlantic City, N. J. App. filed Oct. 23, 1916. An electric lamp base comprising an outer socket-engaging shell and an inner bulb-carrying shell which slide on each other, thus preventing unauthorized removal of lamp.

1,229,272. INSULATOR; John J. Irwin, Cleveland, Ohio. App. filed Dec. 30, 1916. Transverse groove in top within which the line wire rests.

1,229,288. ELECTRIC WELDING; Otis A. Kenyon, New York, N. Y. App. filed March 3, 1917. Relates primarily to controlling the length of the arc by a voltage limitation, adjustable and independent of the voltage of the generator.

1,229,294. AUTOMATIC SWITCH; Frank A. Kuntz, Richmond Hill, N. Y. App. filed Aug. 19, 1915. Acts as a magnetic blowout to destroy arcs.

1,229,308. ELECTRIC GENERATOR; John C. Morgan, Los Angeles, Cal. App. filed April 25, 1916. Designed to eliminate the use of dry batteries.

1,229,347. TELEPHONE - CALL - REGISTERING DEVICE; Victor Thompson, Vancouver, B. C., Canada. App. filed April 14, 1916. Provides means by which a subscriber may buy as many "flat-rate" calls as may be desired.

1,229,351. IGNITION SYSTEM; Harry R. Van Deventer, Sumter, S. C. App. filed Dec. 28, 1916. Igniter controlled by the ignition current.

1,229,444. CONTROL SYSTEM; Arthur J. Hall, Wilkinsburg, Pa. App. filed Oct. 23, 1913. Controller-actuated device arranged to permit of operation singly or in multiple with others.

1,229,446. ACCELERATOR AND SYSTEM OF CONTROL; Arthur J. Hall and Lynn G. Riley, Wilkinsburg, Pa. App. filed Sept. 27, 1916. Electrically controlled fluid-actuated operating mechanism for moving a controller drum in opposite directions either in a step-by-step movement or continuously.

1,229,460. INDICATING ELECTRIC CONNECTOR; Charles Horn, Millbourne, Pa. App. filed May 18, 1914. Improvements.

1,229,463. ELECTRIC SIGNALING SYSTEM; Harvey Hubbell, Bridgeport, Conn. App. filed Aug. 10, 1916. Transmits signal simultaneously to several stations.

1,229,464. PULL SOCKET; Harvey Hubbell, Bridgeport, Conn. App. filed Nov. 29, 1916. Means for increasing the current-carrying capacity of the switch.

1,229,473. AUTOMATIC MAKE-AND-BREAK DEVICE; Patrick S. Keenan, Denver, Col. App. filed March 30, 1916. Improvements.

1,229,489. SWITCH; Alexander J. Loguin, West Allis, Wis. App. filed Sept. 6, 1910. Relates especially to automatically operated switches to be used in systems of remote control.

1,229,530. MEANS FOR OPERATING SWITCH MECHANISMS; Ralph A. Schoenberg, New York, N. Y. App. filed Aug. 13, 1915. contact stud operated by oscillating member and buckling spring.

1,229,544. SYSTEM AND APPARATUS FOR CONTROLLING ELECTRIC MOTORS; Norman W. Storer, Pittsburgh, and Arthur J. Hall, Wilkinsburg, Pa. App. filed Sept. 27, 1916. Power-actuated drum controllers which can be used singly or in multiple with others.

1,229,566. SWITCH-POINT OPERATOR; Rafael Alcolea, New Orleans, La. App. filed Feb. 24, 1915. For automatically operating the switch point or points from a vehicle moving on a railway track.

1,229,576. OUTLET BOX; John C. Boyton and Oris H. Nickerson, Cleveland, Ohio. App. filed Jan. 25, 1913. May be enlarged without special tools.

1,229,596. NON-GROUNDED REPEATER SYSTEM; Edward D. Fales, Chicago, Ill. App. filed June 4, 1907. Automatic or semi-automatic telephone-exchange system in which the automatic switches are controlled through the medium of non-grounded line circuits.

1,229,634. TELEPHONE TRANSMITTER; Ray H. Manson, Elyria, Ohio. App. filed Aug. 17, 1914. Keeping the parts in proper adjustment.

1,229,635. SNAP SWITCH; Fredrich W. Marschke and William A. Marschke, Indianapolis, Ind. App. filed Sept. 11, 1916. For electric motors, and designed automatically to increase the electromotive force impressed on the motor after the closing of the circuit.

1,229,651. MEANS FOR ATTACHING ELECTRICAL APPLIANCES TO CONDUIT OUTLET BOXES; John E. Parker, Syracuse, N. Y. App. filed June 19, 1911. Conduit outlet box having an opening in one side and means for attaching an electric appliance.

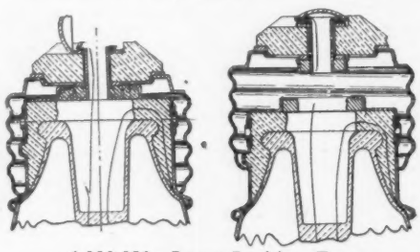
1,229,665. FITTING FOR ELECTRICAL CONDUITS; Klaas Sixma, Brooklyn, N. Y. App. filed May 5, 1914. Externally threaded bushing, which may be used with or without internal threads to coact with threads on the conduit.

1,229,670. STARTING SWITCH; Alexander K. Sutherland, New Britain, Conn. App. filed May 11, 1916. Handle is slightly retracted to permit moving from one position to another.

1,229,689. CURRENT TRANSFORMING AND RECTIFYING APPARATUS; Julius B. Wantz, Chicago, Ill. App. filed Nov. 5, 1914. A rotary member carrying current-conducting members adapted to co-operate with stationary shoes.

1,229,699. HIGH-POTENTIAL-MEASURING DEVICE; James C. Armor, Ingram, Pa. App. filed April 30, 1915. Spark gap in multiple with one of several condensers to prevent undue voltage strains or surges.

1,229,700. ELECTRIC WELDING PROCESS; Carl B. Auel, Wilkinsburg, Pa. App. filed Dec. 10, 1914. For joining thin sheets and ribbons of metals.



1,229,231—Lamp-Locking Base

1,229,703. LATCHING DEVICE; Harold G. Baxter, Wilkinsburg, Pa. App. filed June 9, 1914. To prevent knife blade from becoming accidentally disengaged from contact members.

1,229,709. SPRINGLESS OR FLOATING SUSPENSION FOR VEHICLES; Giuseppe Bravi, Allentown, Pa. App. filed Nov. 29, 1915. Movable members coacting with equalizing bars in such manner that the coacting or adjacent parts operate as a variable triangle.

1,229,719. CUT-OUT; Frank Conrad, Swissvale, Pa. App. filed April 2, 1913. Automatically closes the charging circuit at a predetermined voltage and opens the circuit when current begins to flow from the battery to the generator.

1,229,727. WELDING SYSTEM; Earl E. Eby, Wilkinsburg, and Sidney W. Farnsworth, Pittsburgh, Pa. App. filed Oct. 15, 1914. Auxiliary circuit is employed for maintaining the rectifier arc.

1,229,728. WELDING SYSTEM; Earl E. Eby, Wilkinsburg, Pa. App. filed Oct. 15, 1914. Current rectifiers are employed to convert the alternating current into direct current for the welding circuit.

1,229,740. MEASURING INSTRUMENT FOR ROENTGEN RAYS; Robert Furstenau, Berlin, Germany. App. filed Jan. 28, 1914. Wheatstone bridge having a selenium cell for exposure to the rays in one of its two parallel resistance branches.

1,229,749. PHONOGRAPH; Newman H. Holland, West Orange, N. J. App. filed Sept. 17, 1914. Telephonic connections whereby sounds may be recorded and transmitted to any desired distance.

1,229,750. KNIFE-BLADE SWITCH; Frederick B. Holt. Antrobus, England. App. filed Aug. 25, 1916. Terminal members are formed of a continuous piece of strap copper that extends from the front to the back of the panel or base.

1,229,759. SUPPORT FOR ARMATURE CROSS-CONNECTORS; George H. Krauskopf, Pittsburgh, Pa. App. filed Jan. 15, 1913. Z-shaped ring member which fits beneath projecting flange upon the end plates of the armature.

1,229,767. ELECTRICAL MEASURING INSTRUMENT; Paul MacGahan, Pittsburgh, Pa. App. filed July 29, 1913. Means for adjusting the zero position of spring over any range without changing the counter-torque of the spring.

1,229,768. CIRCUIT INTERRUPTER; Joseph N. Mahoney, Wilkinsburg, Pa. App. filed Aug. 11, 1913. Means for inserting a reactor in an electrical circuit under predetermined conditions of operation.

1,229,785. WATER-STAGE INDICATOR; Delbert W. Proebstel, Treadwell, Alaska. App. filed March 31, 1914. Intermittent rotation of indicator produced by successive changes in polarity of magnets.

1,229,789. CIRCUIT INTERRUPTER; Karl C. Randall, Edgewood Park, Pa. App. filed June 9, 1914. Means for equalizing the currents traversing circuit interrupters, which are connected in parallel relation.

1,229,796. TELEGRAPH AND TELEPHONE SYSTEM; Josef Schiessler, Baden, near Vienna, Austria. App. filed May 22, 1914. Relates to electric telegraphy or telephony by submarine cables and long-distance overhead.

1,229,823. IGNITION APPARATUS OF GAS ENGINES; Claude S. Sydenham, Kilmarnock, Scotland. App. filed Feb. 17, 1914. Improvements of the type having a stationary insulated electrode and a moving uninsulated electrode.

1,229,841. DYNAMO-ELECTRIC MACHINE; Wilhelm Weller, Pankow, and Hermann Nehlsen, Niederschonhausen, Germany. App. filed July 16, 1915. Provided with both commutator and collector rings.

1,229,856. HIGH-FREQUENCY ALTERNATOR; Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed June 22, 1915. Inductor type having wide slots for the armature winding.

1,229,876. MAGAZINE ARC LAMP; James Brockie, Forest Hill, London, England. App. filed Feb. 16, 1914. Arc is restarted when the new carbons have been fed forward to within a distance less than that between the burning carbons.

1,229,914. ELECTRICAL CONDENSER; Philip Dubilier, New York, N. Y. App. filed May 2, 1916. Compact construction capable of radiating heat quickly.

1,229,915. ELECTRICAL CONDENSER; William Dubilier, New York, N. Y. App. filed Jan. 18, 1916. Made up of a plurality of sections connected so that the potential applied to the unit is divided among the sections.

1,229,931. SAFETY SIGNAL; Charles R. Funk and Lewis H. Smith, Emporia, Kan. App. filed July 14, 1916. Direction indicator for attachment to a motor vehicle.

1,229,939. ELECTRICAL THERMOSTAT AND CIRCUIT; Albert Goldstein, New York, N. Y. App. filed Nov. 18, 1914. Air expansion in a closed chamber actuates a diaphragm to close a circuit.

1,229,950. ARC LAMP; Charles E. Harthan, Lynn, Mass. App. filed Aug. 12, 1915. Differential type.

1,229,995. CABLE POTHEAD; George F. Mainer, San Francisco, Cal. App. filed March 20, 1916. Elimination of wiped joint.

1,230,003. SAFETY ATTACHMENT FOR SYNCHROSCOPES; Pliny E. Means, Tyrone, N. M. App. filed Aug. 6, 1915. Prevents tying together of two sources of alternating electric current until the same are in synchronism.

1,230,004. INCANDESCENT CATHODE DEVICE; George S. Meikle, Schenectady, N. Y. App. filed Sept. 18, 1915. Electrical discharge devices of the gas-filled incandescent cathode type, provided with a rugged main cathode and a separate or auxiliary electrode which operates in conjunction with a start arc that heats the cathode to incandescence preliminary to starting the main arc.

1,230,063. TIME-LIMIT RELAY; George A. Burnham, Saugus, Mass. App. filed April 14, 1913. Solenoid operates a switch against the resistance of a retarding device on moderate overloads, while on heavier overloads the solenoid compresses a spring which thereafter closes the switch against the resistance of the retarding device.

1,230,077. IGNITION SYSTEM FOR INTERNAL-COMBUSTION ENGINES; Guy H. Silva, San Diego, Cal. App. filed March 16, 1916. Automatically advances the spark with increase of the speed of the engine and vice versa.

1,230,089. SWITCH; Walter L. Hamilton, Holyoke, Mass. App. filed March 13, 1915. Operable by sudden changes in temperature.